The OIL WEEKLY

Table of Contents page 19
Advertisers' Index page 16

WORLD OIL

DEVOTED FOR DRILLING
AND OPERATIONS

DECEMBER, 1954

Price This Copy, 50 Cents

"CHERT ISN'T A 'BOGEY MAN' ANY MORE!"

"A few years back, the mere mention of chert sent shivers down my spine. Of course that was before the development of the Hughes heavyweight drilling technique. When we hit chert nowadays we put on a Hughes W7 series rock bit with plenty of drill collar weight, cut the R.P.M. down and presto . . . we're churning through chert. It's another case of a Hughes 'Engineered Solution' for every drilling problem."

HUGHES TOOL COMPANY
HOUSTON, TEXAS

Standard of the Industry

Attention Mr. Pipeliner!

[illegible] THE CRUDE YOU'RE PUMPING

Save up to $5,000 per year

New

BUDA Crude-Burning Diesel cuts costs in pipeline service

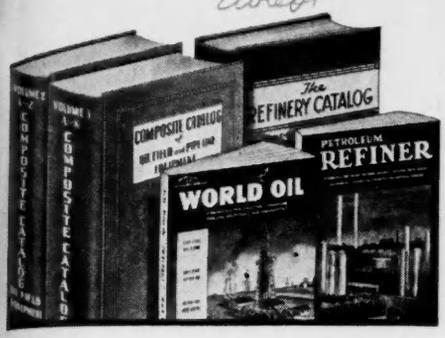
It will pay you to get all the facts immediately about Buda's new 6-DC-1879 Crude-Burning Diesel. This new oil field engine allows you to save money by burning less expensive, easier-to-get crude. Figuring crude at 5¢ and Diesel fuel at 13¢ your saving is 8¢ on each gallon! This means that in a year's time you save around $5,000 in fuel costs. And remember . . . this engine gives you the same dependable Buda stamina, rugged power, and field-tested economy of the famous Buda line — proved by thousands of installations in the oil fields.

See your nearest Buda oil field distributor today. He will show you how this new Buda 6-DC-1879 Crude-Burning Diesel can cut your costs in pipeline service. The Buda Company, Harvey, Ill.

BUDA

Oil Field
ENGINES
Natural Gas • Butane
Gasoline • Diesel
Crude Oil

. . . A *POWER-FULL* NAME IN ENGINES



Specialized Oil Publications of
THE GULF PUBLISHING COMPANY
Box 2608, Houston (1), Texas

WORLD OIL and The COMPOSITE CATALOG
for the drilling-producing-pipe line industry

PETROLEUM REFINER and The REFINERY CATALOG
for the refining-natural gasoline industry

RAY L. DUDLEY, *President, Publisher*
A. L. BURNS, *General Manager*

EDITORIAL STAFF

WARREN L. BAKER, *Editor*
AL REESE, *Managing Editor*
L. J. LOGAN, *Associate Editor*
ELTON STERRETT, *Engineering Editor*
GEORGE O. IVES, *International Editor*
J. E. KASTROP CECIL SMITH M. C. MARQUEZ
MARY E. POOLE, *Librarian*
3301 Buffalo Drive, Houston 6, Texas

HENRY OZANNE
250 Park Ave.
New York 17, N. Y.

GILBERT M. WILSON
W. W. Wilson Bldg.
Huntington Park, Calif.

ANTHONY GIBBON
Hunt Bldg.
Tulsa 3, Okla.

E. N. TIRATSOO
15 Redcliffe Gardens,
SW 10, London

ADVERTISING STAFF

TOM W. NELSON, *Advertising Manager*
RANDALL BROOKS, *Assistant Advertising Manager*

NELSON BIGELOW
FRANK VICKREY
250 Park Ave.
New York 17, N. Y.

ROGER MOTHERAL
1010 Euclid Ave.
Cleveland 15, Ohio

H. G. FITZPATRICK
332 S. Michigan Ave.
Chicago 4, Ill.

BILL ATCHESON
Hunt Bldg.
Tulsa 3, Okla.

J. W. CURTS
W. W. Wilson Bldg.
Huntington Park, Calif.

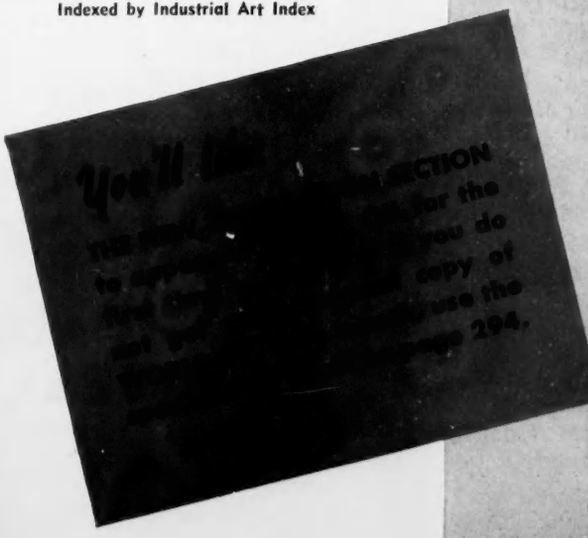
CHARLES WYATT
3301 Buffalo Drive
Houston 6, Texas

CIRCULATION DEPARTMENT

CLINTON S. QUIN, JR., *Manager*

Published every month except semi-monthly in February. Single copies 50 cents (except special issues). Subscription price: domestic and foreign, $2 a year; 2 years, $3; 3 years, $4. Advertising rates on application. Copyright, 1948, by The Gulf Publishing Company.

Indexed by Industrial Art Index



WORLD OIL

Established 1916 as THE OIL WEEKLY

EAST ... LIBRARY
TN
860
.043

CONTENTS

December, 1948 **Vol. 128, No. 8**

NEWS ANALYSIS SECTION

Publisher's Page ... *Ray L. Dudley* 21
The Changing Panorama ... 23
Monthly News Analysis ... 25
Looking Ahead ... 34

CURRENT OUTLOOK SECTION

59.1 Percent of World Reserves Held by U. S. Firms ... *L. J. Logan* 37
Atomic Research May Solve Important Oil Problems ... *Dr. Thorfin R. Hogness* 42
Liquid Fuels from Oil Shale ... *A. J. Kraemer* 48
Petroleum Trends—Crude Stocks at Highest Peak Since Middle 1947 ... *Cecil Smith* 56
Completions Highest in History for October ... 58
Exploration in 10 Months Exceeds All of 1947 ... 60

DRILLING SECTION

Good Engineering Practice Drives Deep Briscoe Well ... *John T. Bedford* 71
Sidewall Sampling Tools and Techniques *(Last of Two Parts)* ... *J. E. Kastrop* 76
Mechanics of Drill-Stem Testing *(First of Two Parts)* ... *Roy E. Edwards* 83
Liquid Surface Measurement Set at One-Millionth of Inch ... 96
Causes and Prevention of Drill Pipe and Tool Joint Troubles *(Third of Six Parts)*, *H. G. Texter and R. S. Grant (Revised by H. G. Texter and S. C. Moore)* ... 100
How To Do It—Drilling Hints ... 114
Deep Oil Possibilities in Illinois ... *L. E. Workman and Alfred H. Bell* 128

PRODUCTION SECTION

Deep Oil Well Pumping ... *Kenneth N. Mills* 137
Sub-Surface Aspects in Kansas Water-Flooding ... *Dr. John Mark Jewitt* 142
Proper Servicing Lengthens Lease Life ... *James E. Haney* 154
Fully Automatic Electric-Powered Gathering Station ... *F. H. Warren* 159
Insuring V-Belt Life ... *E. A. Gahl* 166
Tubing Cutter Helps Stripper Field Work ... *Harry Graves* 168
Oil Production by Gas and Flooding *(Second of a Series)* ... *Park J. Jones* 170
How To Do It—Production Hints ... 176

PIPE LINE SECTION

Arkansas River Pipe Line Crossing ... *E. K. Hartzell* 187
Building Permanent Tank Dikes ... 192
Engine Overhaul Dynamometer Laboratory ... *W. D. Owsley* 193
Basic Problems in Gas Dehydration ... *J. I. Morris* 194
Buckeye Pipe Line Company and Affiliated Companies' System *(57th of a Series)* ... 200
Pipe Line Construction ... 203
How To Do It—Pipe Line Hints ... 206

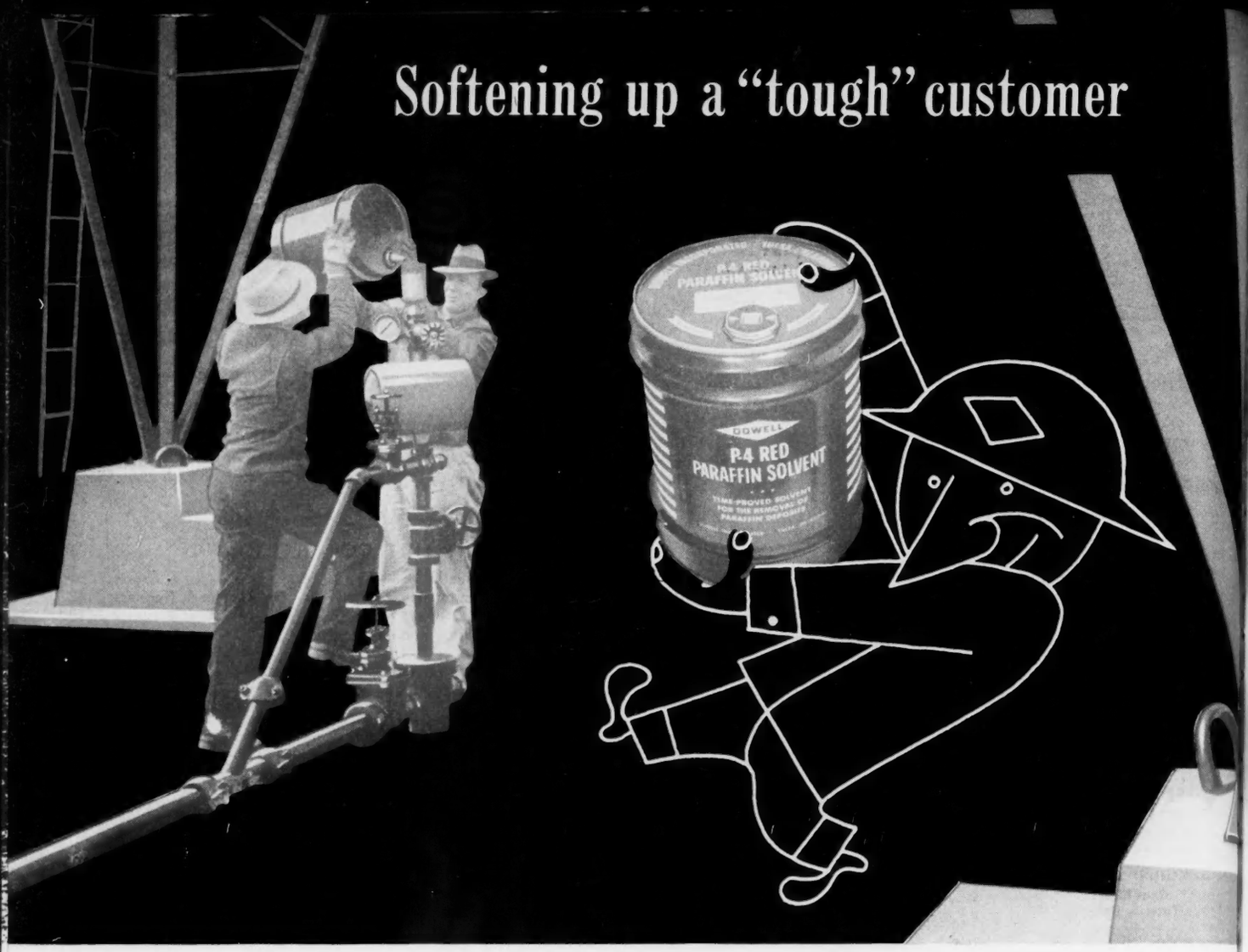
INTERNATIONAL SECTION

Modern Methods Feature Peru's Oldest Operation ... 213
Diplomats Without Portfolio—The American Oil Man Abroad ... *George O. Ives* 218
Saudi Arabia's Expanding Importance Calls for New Investment ... 226
Search for Oil in Ontario ... *Zoe Pauline Trotter* 227
4 Million Acres Taken in Alberta Leasing Program ... *Roy E. Leigh* 232
Standard and Socony to Get Interest in Aramco ... *Henry Ozanne* 234
Middle East Production Makes Sharp New Gains ... 236
U. S. Interests May Help Develop Iranian Oil ... 238
Sechura Contract Delayed by Peruvian Disorders ... 240
American Independent May Get Neutral Zone Rights ... 242

OTHER DEPARTMENTS

New and Improved Equipment Supplementing Composite Catalog ... 245
Other New Equipment ... 258
New Literature ... 262
Associations ... 264
The Oil Man's Calendar ... 268
Men in the Industry News ... 270
Equipment and Service Suppliers' Notes ... 284
New Books ... 303
Squeaks from the Bull Wheel ... 304
Advertisers' Index ... 16
Classified Advertising (Trading Post) ... 302

Softening up a "tough" customer



DOWELL PARAFFIN SOLVENTS are first aid for production problems caused by paraffin deposits.

For a "tough" situation where paraffin deposits are gumming up the works, choose economical, time-tested Dowell Paraffin Solvents, designed to *increase production* in pumping or flowing wells by dissolving the toughest paraffin—even complicated by impurities such as salt and sand.

For example, the production of a dually completed, high-pressure well was cut by paraffin deposits in the tubing and annular space between tubing and casing. The well was shut in and Dowell Paraffin Solvent lubricated into the casing and tubing. The solvent was allowed to remain in contact with the paraffin deposit for several hours. *Result:* After one small Dowell Paraffin Solvent treatment, *the flow increased from 150 to 195 b.o.p.d.!*

Dowell Solvents have also proved effective in cleaning lead lines, tank bottoms, screens, liners, perforations and in rerunning rods.

For year-'round paraffin control, secure a supply of Dowell Paraffin Solvents from your nearest supply store or Dowell station. Ask for your free copy of "Time Proven Methods for Removal of Paraffin Deposits", an authoritative, handbook.

DOWELL, INCORPORATED
TULSA 3, OKLAHOMA
Subsidiary of The Dow Chemical Company

DOWELL
PARAFFIN SOLVENTS

Ask your nearest Dowell station for complete information on these Dowell services and products: Acidizing, Electric Pilot Services, remedial Plastic Service, Chemical Scale Removal Service for heat exchange equipment, Jelflake, Paraffin Solvents and Bulk Inhibited Hydrochloric Acid.

"Petroleum Promotes Progress"

Look to DOWELL

FOR OIL INDUSTRY CHEMICAL SERVIC

API AND THE INDUSTRY

THIRTY YEARS of attending the annual meeting of an organization affords a pretty fair background for evaluating the work done by that organization. But even with a background which antedated the first formal meeting of the American Petroleum Institute by at least a year, we have some hesitancy in sticking our neck out because of the tendency to engage in reminiscences, rather than engaging in evaluation.

IF WE were called upon to express in a minimum of words the impressions gained in what amounts actually to 30 years of observing API meetings first hand, we would say that we are struck with the close parallel between API programs and the progress which the industry has undergone during those years. Not long ago we studied the first API program. The subjects were pretty general, and most of us who were on that first program executed our jobs by giving expression to generalities.

AS WE think of it now, the program must have been pretty dull, although it was highlighted by a speech from Walter Teagle, then head of Standard Oil Company (N. J.), who assured us of the stability of a price structure which toppled not long afterwards. When the crude price crash came nobody blamed Mr. Teagle for deception, and he probably felt very much like Mr. Gallup felt November 3. Of equal interest was a debate between the chief legal light of a large oil company and the Ambassador from Mexico on the subject of certain actions on the part of the Mexican government affecting oil. The audience seemed to be divided into two groups, a large one embracing American oil men, and a very small group consisting of the ambassador and attaches to the Mexican embassy. Both sides felt that their champion had won!

BUT WITH the second meeting the API programs began to hit their stride. The subjects discussed in the general meetings, and even in what then passed for committee meetings, took on a practical and scientific atmosphere. There followed the great effort of API on standardization of drilling and production equipment which has had so many ramifications.

AND AS time passed on, anyone attending an API meeting could be assured of three things—three things greatly to be desired:

1. He could attend technical meetings at which practical subjects were discussed in papers and then in informal manner following delivery of the paper.
2. He was assured of a message from some outstanding personality or personalities in the general sessions. In this connection, although we never have been considered an admirer of the personality, we did get at San Francisco a new insight into the public character of Harold Ickes which led us to suspect that he would do a bettter job as petroleum co-ordinator than we had believed possible.
3. Finally, a person attending an API meeting could be assured of meeting his friends in the oil business under conditions which strengthened many an already warm friendship. In retrospect we see men whose names will forever stand high in petroleum annals. The temptation to mention names is nearly overpowering, but unless all could be mentioned we would be unfair by omission.

WHAT HAPPENED in those early days continues. Unfortunately, some of the stigma of the API being the "big company's association" still remains although, we think, unfairly so.

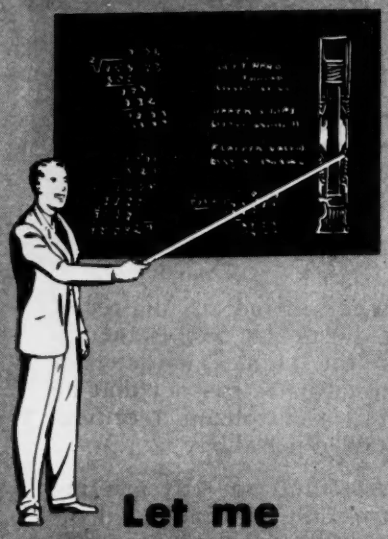
THE QUESTION naturally arises: "Did the API programs over the years merely reflect the progress being made within the industry, or did those programs actually lead, or help to lead, the industry in its thinking?"

THE API has unquestionably contributed greatly to the thinking of the industry. As time wore on, its programs became the pattern for other oil associations, all with good effect upon the progressive spirit which has so marked the industry.

FOR MORE than 30 years we have seen API working intelligently and aggressively for practices and measures of great value to the industry and the public. But we also have seen API sidestep action, when, in our humble judgment, it should have hewed to the line of industry-public good.

WE HAVE seen a greater appreciation of the value of public relations grow year by year—quite a different attitude than existed for several years. And now API is very properly leading an industry-wide effort to acquaint the public with the nature and scope of oil industry affairs. Much has been accomplished, but there is still much to do. For one, we think that the time has come for the industry to bear down, even more, on the indispensability to the American public of an aggressive, privately operated oil industry. Such a program could hardly be emphasized until there was a better understanding by the public as to how the industry operates. But that time has arrived.

Ray L. Dudley



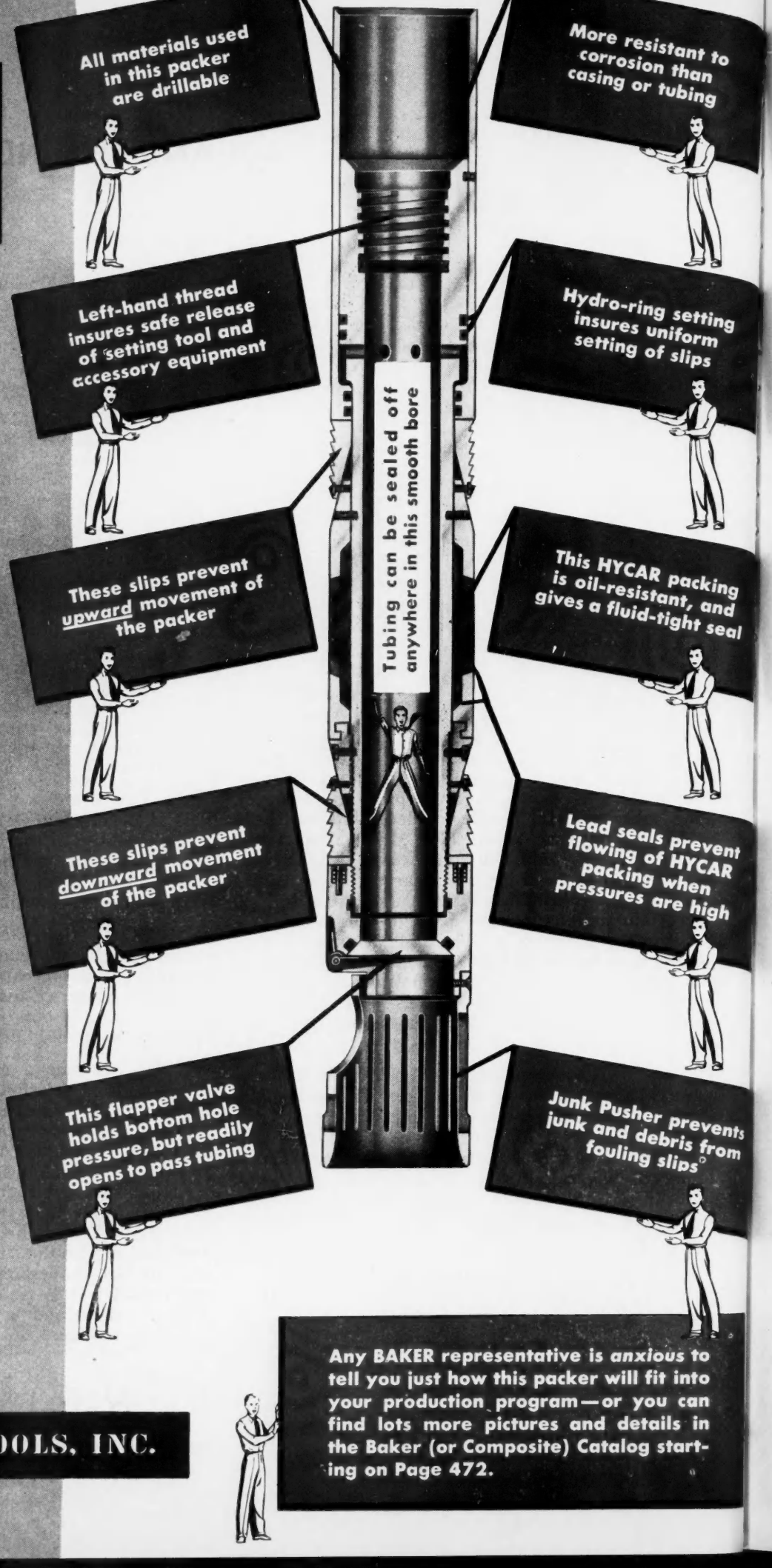
Let me point out a few of the outstanding features that make the

BAKER

RETAINER PRODUCTION PACKER

(Product No. 415-D)

FIRST CHOICE EVERYWHERE


All materials used in this packer are drillable
More resistant to corrosion than casing or tubing
Left-hand thread insures safe release of setting tool and accessory equipment
Hydro-ring setting insures uniform setting of slips
Tubing can be sealed off anywhere in this smooth bore
These slips prevent upward movement of the packer
This HYCAR packing is oil-resistant, and gives a fluid-tight seal
These slips prevent downward movement of the packer
Lead seals prevent flowing of HYCAR packing when pressures are high
This flapper valve holds bottom hole pressure, but readily opens to pass tubing
Junk Pusher prevents junk and debris from fouling slips

Any BAKER representative is *anxious* to tell you just how this packer will fit into your production program—or you can find lots more pictures and details in the Baker (or Composite) Catalog starting on Page 472.

BAKER OIL TOOLS, INC.

The Changing Panorama

Competition Insures Enough Oil

THE HIGHLY competitive nature of the petroleum industry was cited by nearly all of the speakers at the general sessions of the API at Chicago, November 10-11. This fact is quite noteworthy. For each speaker had done his own thinking and each had an altogether different subject. Yet in developing his subject, each speaker was impressed by the vital role of competition in the operations and service performed by the industry.

Vigorous competition among oil companies in serving the public largely explains the fact that the industry has virtually solved the oil supply problem of the past year, and this keen competition also has kept oil prices from increasing as sharply as the prices of most other products, declared Dr. Robert E. Wilson, chairman of the board of Standard Oil Company (Indiana).

Importance of competition and free enterprise in assuring efficient and successful operation of the industry was emphasized not only by Wilson but also by several other speakers, including William R. Boyd, Jr., president of the API; Frank M. Porter of Oklahoma City, president of Fain-Porter Drilling Company and president of the Mid-Continent Oil and Gas Association; and Senator George W. Malone, Republican, Nevada.

Although there remain the usual uncertainties regarding strikes, military demand, and severity of the winter, stated Wilson, the supply problem now seems to be definitely "licked." The super-demand for oil products over the past year has been met, he said, in spite of shortages of steel, manpower, and money, and in spite of inadequate transportation facilities.

The answer to how this great demand has been met, said Wilson, lies in three C's — Cooperation, Conservation, and Competition.

"Competition alone explains the tremendous drive producers have put on to find more oil, the building of new refinery units, the opening up of old refineries, and operating obsolete submarginal units, the extension and enlarging of pipe lines, and the addition of tankers and barges to the waterborne oil-carrying fleet on the scale of the last two years.

"It is competition that has prodded the industry into pouring nearly five billion dollars into new facilities since 1946," stated Wilson, "with the industry spending more for that purpose each year than its total net earnings and seriously enlarging the debt it must manage in an unpredictable future."

Competition among oil companies has not only solved the supply problem but it also has continued to hold prices down, declared Wilson. "Of the 50 commodity groups in the government's wholesale price index," he said, "41 show greater increases than do petroleum products."

API President Boyd in his customary annual address referred to the traditional keen competition among individual companies in denying that any particular companies or groups of companies controlled the affairs of the Institute. Actually, he asserted, the companies differ greatly among themselves regarding industry problems and affairs and constantly compete with each other for business.

Porter deprecated excessive studies and investigations of petroleum industry operations by Congressional committees, subcommittees, and agencies, and gave assurance that a competitive oil industry would commendably perform its responsibilities if not handicapped too greatly by government interference.

Senator Malone declared that the greatest quantity of petroleum could be produced for U. S. needs "through the competitive business system—owned and controlled by the men who survive and build up successful producing and marketing organizations through their energy, endurance, and know-how.

"The phenomenal success of the oil industry in keeping pace with the public needs over the past 40 years has been largely due," Malone added, "to rewards in profits to investors—investors who were willing to gamble in exploration and wildcat drilling operation—where the risk was great—but the rewards were also great when new fields were discovered.

Reserves Vary With Crude Price Changes

FAVORABLE PRICES for crude are necessary to assure maximum crude reserves and resultant continuous adequate supply of petroleum products. Good prices for crude add to reserves, in the first place, because they stimulate drilling and exploration and attract risk capital into the search for new fields. In the second place, favorable crude prices even more rapidly affect crude reserves by materially increasing the economically recoverable reserves in existing fields.

Reese H. Taylor, president of Union Oil Company of California, stated recently in an address in New York that his company had compared the improved crude prices of 1948 with those of 1946 and had analyzed the effect of the prices on the economically recoverable reserves in four of the fields in which the company operated.

"We found," said Taylor, "that the crude price increases over the last two years had increased the recoverable reserves—from here on out in the life of the field—26 percent in the first field, 42 percent in the second, 20 percent in the third, and 33 percent in the fourth. This amounted to some 64 million additional barrels of crude oil that can be recovered from the four fields at today's prices (assuming those prices hold) over what would have been economically recoverable at 1946 prices."

Summarizing, Taylor pointed out that "when authorities say that the nation has 26 billion barrels of crude oil reserves, the layman is apt to think of this figure as the total amount of oil available. But what the figure actually represents is the amount of economically recoverable crude petroleum reserves at today's prices."

GREETINGS

HALLIBURTON OIL WELL CEMENTING CO.

DUNCAN, OKLAHOMA

MONTHLY NEWS ANALYSIS

ELECTION MAY MEAN STRICTER CONTROLS . . . ENOUGH OIL FOR U. S. EXPECTED CRUDE PRICE HIKED . . . TEXAS COMMISSION'S SHUTDOWN POWER CHALLENGED

Truman's Election May Mean Greater Government Meddling

Increased government intrusion into oil and gas industry affairs is strongly threatened by the election of Truman and the voting of Democrats into control of both House and Senate. More and stricter controls over business were pledged by Truman in his campaign speeches, and as he seeks to carry out his "new New Deal," he will have strong support in both houses of Congress. The petroleum industry may be affected by both general business legislation, such as Truman's anti-inflation program, and by specific legislation dealing with oil and gas matters.

In the anti-inflation program which President Truman will ask the new Congress to enact, he seeks standby controls which would affect especially the petroleum, steel, and other basic industries. The controls would be applied, Truman promises, only if voluntary measures are unsuccessful. These controls would be in the form of allocations, rationing, and price regulation, and would affect commodities that influence cost of living, including petroleum products and other fuels. The controls would be applied if short supply and rising prices of the commodities threatened to extend the inflationary spiral.

Both oil and gas industries see in the Democratic victory a reduced possibility of legislation curbing the authority of the Federal Power Commission, such as that which was sought without success but with some encouragement in the Congress of 1948. The Moore-Rizley gas bill for curbing FPC died in committee after having shown some promise of enactment. Thus the threat still remains that the federal government may seek to control production of natural gas and eventually the production of petroleum, on the grounds that these commodities go into interstate commerce.

What of the Tidelands?

Another important legislative matter widely regarded as having been affected unfavorably by the Truman victory is the tidelands question. The results of the election indicate that it may be extremely difficult for sponsors of tidelands quitclaim legislation to succeed. Representative Ed Gossett (Democrat, Texas) said after the election that he would reintroduce his bill to give clear title to the tidelands to the states. He recalled that in the last congress the House passed the bill by an overwhelming 257 to 29 vote, and thought the House would pass the measure again, leaving final decision to the Senate.

President Truman vetoed the bill that was passed in 1948, and though the House overrode his veto, the Senate did not vote on it after the veto, because threatened with a filibuster and with shortage of enough votes to override. If the new Congress passes a tidelands quitclaim measure, it may be vetoed as was the bill passed in 1948, and overriding of a Democratic President's veto might be more difficult in a Democratic 81st Congress than it was in the Republican 80th Congress. On the other hand, a Democratic President might not veto a tidelands bill passed by a Democratic Congress as readily as he vetoed the one passed under leadership of the Republican party.

Instead of quitclaim legislation, the Truman administration may try to get favorable Congressional action on its bill for tidelands oil development, which was pigeonholed after being introduced last winter. Drafted jointly by the Justice, Defense, and Interior Departments, it provides for federal leasing of submerged lands off the coast. The federal government would exchange federal leases for state leases, under this bill, except where the government decides to withdraw certain areas as military oil reserves. The federal government would regulate development, production rates, and other operations.

Following Truman's election, it was predicted that he would soon order Attorney General Clark to file suits that Clark has ready, claiming federal title to submerged lands off the Texas and Louisiana shores. These cases would be based on the Supreme Court ruling that California does not own its tidelands and that the U. S. government has paramount rights over those lands as a matter of national defense.

Development of tidelands oil is proceeding in California under leases obtained from the state, but with revenue for account of landowner being set aside pending judicial determination whether it shall go to federal or state government. Development is proceeding also off the coasts of Louisiana and Texas, encouraged by recent establishment of production on several offshore salt domes.

However, all offshore activity naturally is retared to a great extent by the many uncertainties regarding ownership of the submerged lands and validity of leases granted by the states. Numerous questions are raised, and they will not be settled until acted upon by Congress and carried through the courts. Oil companies henceforth naturally will act very cautiously in putting capital into offshore development of lands held under leases that could prove invalid, with ownership of them in question.

So far, any development must be under leases from the states, as there has not been any leasing of the submerged lands by the federal government, although efforts are being made to get federal exploration leases. Following the Supreme Court decision in the California tidelands case, however, there is uncertainty about the validity of any of these state leases, including those covering lands off the coasts of Louisiana and Texas. It is uncertain what rights the companies holding these state leases would have if the federal government successfully made claim to the lands involved.

Federal Leases Sought

In view of this uncertainty regarding ownership, numerous oil companies, individuals, and oil cooperatives have sought to obtain leases from the U. S. government. In an address at Houston

recently before the American Association of Oilwell Drilling Contractors, Price Daniel, attorney general of Texas, stated that 17 oil co-ops had applied to the Department of Interior for exploration leases on 1700 square miles of submerged lands off the Texas and Louisiana coast. In addition to the co-ops, many oil companies and individuals also have applied to the federal government for offshore exploration leases, covering areas adjacent to California and Gulf Coast states.

It was the contention of all who applied that the Department of Interior should grant leases to the submerged lands under the Federal Mineral Leasing Act. Under that law the Department of the Interior is authorized to grant exploration leases on national lands in non-producing or wildcat areas. Under these exploration leases the department is obligated to lease any tract to the first applicant seeking such lease, charging the lessee a bonus of 25 cents per acre for the first year. (In contrast, the state of Texas has received an average of more than $20 per acre bonus for leases it has given on lands off its coast.) Following the decision in the California case there were many applications for federal leases.

The Interior Department held these applications in abeyance until early 1948. Then it denied all the applications, on the grounds that it did not have authority to lease the submerged lands. Secretary of Interior Krug stated that he had no authority to lease the lands until a law had been enacted by Congress creating a special tidelands leasing law.

This was not, however, the end of the applications for federal leases on the submerged lands. Some of the applicants have gone to the courts seeking to force the giving of the leases applied for. Former Senator Burton K. Wheeler, as attorney for a group of these applicants, has filed suit in Federal District Court, District of Columbia, at Washington, D. C., seeking a mandamus order to require the Department of Interior to give the desired leases, under the Federal Mineral Leasing Act. This is a test case, and if the plaintiffs are successful, the Department of Interior will have to give federal leases on the submerged lands. Such a decision would be a heavy blow to the advocates of retention of title to the submerged lands by the states.

Price Daniel's Views

In view of the results of the national election, it is felt in many quarters that the states are doomed to lose in their claims to the tidelands.

In contrast with that view, Price Daniel, attorney general of Texas and one of the leaders in the cause of the states, upon being interviewed by an editor of World Oil, expressed hope that the claims of the states ultimately would be upheld, with Congress enacting legislation to recognize ownership by the states.

It was a Democratic Congress, said Daniel, which passed the original resolution in 1945, giving clear title to the tidelands to the states. And at that time, President Truman vetoed the measure not on the merits of the case but on the grounds that litigation over California tidelands was under way in the courts and that the courts rather than Congress should decide the matter.

When tidelands quitclaim legislation was voted upon by the 80th Congress in 1948, Daniel added, it was approved by a majority of the Democrats in both houses. Likewise, he predicted, quitclaim legislation to be offered in the 81st Congress also will have the support of a majority of the Democrats in both House and Senate. With both houses controlled by these Democrats, he reasoned, a bill enjoying their approval should have a strong chance for enactment into law.

Delving further into the possibilities for quitclaim legislation, Daniel stated that the Democratic party in its convention in Philadelphia was offered but rejected a proposed plank for its platform asserting federal claim to the tidelands. This proposal was made by former Secretary of Interior Harold L. Ickes, but the leaders of the party rejected it, and the platform was silent on the question.

Further said Attorney General Daniel, President Truman in his campaign did not make the tidelands question an issue. Truman did not in any speech advocate federal ownership of the tidelands, said Daniel, although some of Truman's supporters did so.

President Truman has not made up his mind on whether to support federal or state claims to the tidelands, according to Daniel. The Texas attorney general added that he and Senator Tom Connally of Texas had conferred with the President about the tidelands question and that Truman promised them he would hear and give full consideration to the supporters of the states' claims before reaching a decision as to what stand he himself should take.

An important point that Attorney General Daniel strongly emphasized was that the tidelands question is not exclusively an oil matter. The threat of federal control over the tidelands is a threat to all states, not merely oil-producing states, he declared. If the federal government can take over offshore oil lands, he said, it can similarly take over fishing operations, oyster beds, piers, and harbor facilities in all coastal states including those on the Atlantic seaboard, and it can assert authority over the kelp or seaweed industries of Maine and California. Furthermore, added Daniel, the rights of even the inland states are involved, as every attorney general and governor in attendance at the latest governor's conference agreed that the theory of federal rights to the tidelands could be stretched to include similar rights over the rivers, streams and lakes.

Enough Oil for U. S. Use In Next Decade Foreseen

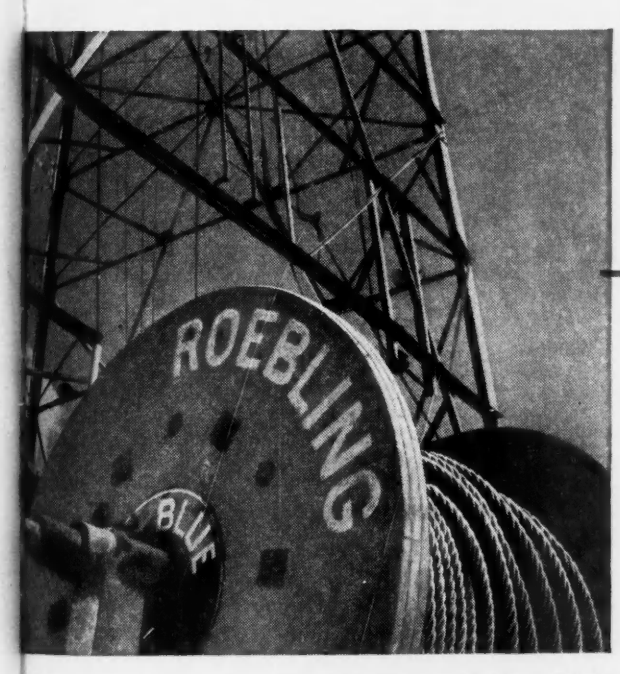
Strong assurance that the U. S. can have ample supplies of petroleum products during the next ten years was given by Leonard F. McCollum, president of Continental Oil Company, in a speech before the API at Chicago. He was discussing the report of an API committee, of which he was chairman.

"Total availability of petroleum and petroleum products for consumption in the U. S. will increase substantially during the ten years, 1949-1958, inclusive," concluded the "Report on the Long-Term Availability of Petroleum."

"The study shows," said the report, "that petroleum liquids from natural sources will be available within the U. S. in substantially increasing amounts; that under favorable conditions there will be increasing amounts of petroleum readily available from other areas in both the Western and Eastern Hemispheres for importation into the U. S. if needed; and that there are abundant sources of raw materials within the U. S. from which petroleum products can be produced synthetically to supply all needs if it becomes necessary or advisable to produce them by this method. In short, this nation can continue to grow through the use of petroleum products as a major source of energy."

The report pointed out that petroleum products for consumption in the U. S. may be obtained from three principal sources: (1) domestically produced crude petroleum and natural gas liquids; (2) synthetic production from natural gas, oil shale and coal; and (3) petroleum produced in foreign countries. All three sources were considered in the survey, with detailed estimates shown for the five years 1949-1953, inclusive, and a more general analysis for the five years 1954-1958.

Domestic production of crude petroleum will average about 5½ million barrels daily in 1948, and the committee estimated it would increase in 1949 to a range of 5,670,000 to 5,850,000 barrels daily or an average estimate of 5,760,000 daily; in 1950 to range of 5,840,000 to 6,150,000 or average of 5,995,000 daily; in 1951 to 5,970,000 to 6,410,000 or average of 6,190,000; in 1952 to 6,050,000 to



BACK OF SPEEDING LINES OF CARS are bustling production lines. And back of *them* is a vision typically American . . . a vision based on the confidence that industry could devise new techniques and place the one-time "luxuries of kings" within the reach of everyone.

With confidence like that, Roebling has led the way in developing and making products that are unsurpassed in performance and low operating cost. The confidence our products and engineering have won throughout industry is an asset that every Roebling employee works to preserve.

HOW OIL MEN CUT WIRE ROPE COSTS!

ROEBLING PREFORMED "BLUE CENTER" STEEL WIRE ROPE slashes costs wherever severe bending is encountered. The unequalled combination of Roebling "Blue Center" Steel and Roebling preforming gives you tops in flexibility and wire rope service life.

You'll find that Roebling Preformed "Blue Center" saves time and money in other ways, too. It's easy to handle, for it doesn't twist or kink. You can cut it without seizing. Broken wires lie flat and don't puncture the hands. It reduces whipping . . . spools uniformly and smoothly.

Your Roebling Field Man can tell you whether Preformed will cut costs on *your* installations. His answer will be impartial, for Roebling makes both Preformed and Non-Preformed . . . a rope that's exactly *right* for every given job. Write or call him at your nearest Roebling branch office.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

Distributed by: **The National Supply Company**
Republic Supply Company

ROEBLING

JAR ROEBLING

★ *WIRE ROPE AND STRAND* ★ *FITTINGS* ★ *SLINGS* ★ *SUSPENSION BRIDGES AND CABLES* ★ *AIRCORD, AIRCORD TERMINALS AND AIR CONTROLS* ★ *AERIAL WIRE ROPE SYSTEMS* ★ *ELECTRICAL WIRE AND CABLE* ★ *SKI LIFTS* ★ *HARD, ANNEALED OR TEMPERED HIGH AND LOW CARBON FINE AND SPECIALTY WIRE, FLAT WIRE, COLD ROLLED STRIP AND COLD ROLLED SPRING STEEL* ★ *SCREEN, HARDWARE AND INDUSTRIAL WIRE CLOTH* ★ *LAWN MOWERS*

6,610,000 or average of 6,330,000; and in 1953 to range of 6,080,000 to 6,770,000 or average of 6,425,000 daily.

Domestic output of natural gas liquids in 1948 will average about 400,000 barrels daily. The committee estimated this would increase in 1949 to 450,000 barrels daily; in 1950 to a range of 470,000 to 480,000 barrels daily or an average of 475,000 daily; in 1951 to 490,000 to 510,000 or an average of 500,000; in 1952 to 510,000 to 530,000 or average of 520,000; and in 1953 to 520,000 to 550,000 or an average of 535,000 barrels daily.

Combining the figures for crude petroleum and for natural gas liquids gives total volume of natural liquid hydrocarbons. This total is about 5,900,000 barrels daily for 1948. It will increase, according to the estimates, in 1949 to a range of 6,120,000 to 6,300,000 barrels daily or an average of 6,210,000 daily; in 1950 to 6,310,000 to 6,630,000 or average of 6,470,000; in 1951 to 6,460,000 to 6,920,000 or an average of 6,690,000; in 1952 to 6,560,000 to 7,140,000 or an average of 6,850,000; and in 1953 to 6,600,000 to 7,320,000 or average of 6,960,000 daily. As compared with the 1948 production of 5,900,000 barrels daily in 1948, the average of the upper and lower range of estimated availability equals 6,960,000 barrels per day in 1953, an increase of 1,060,000 daily over 1948. The probable range in availability from this average figure of 6,960,000 barrels daily varies from a minimum of 6,600,000 barrels per day in 1953 to an upper figure of 7,320,000 barrels daily for that year. The lower range represents an increase of 700,000 barrels daily during the five years over 1948 production, whereas the upper range is equivalent to a 1,420,000-barrel per day increase over the 1948 output.

The report does not indicate any sharp or substantial decline in the availability of domestically produced crude petroleum and natural gas liquids during the second five-year period, 1954-1958, though it did not attempt to predict whether that period would bring a moderate decline, a maintenance of existing levels, or a continuing increase after 1953.

Supplementing the natural petroleum liquids produced in the U. S. during the next five years, the estimated availability of petroleum products from synthetic processes, under foreseeable economic conditions, is relatively small, stated the report, with the volume reaching approximately 30,000 barrels daily of oil products converted from natural gas by 1953. "However," the report continued, "technically feasible and operable processes for the conversion of natural gas, oil shale, and coal to oil products have been developed, and large sources of supply of those raw materials exist."

Production of foreign petroleum is estimated by the committee to increase substantially during the five years 1949-1953. Total estimated production of crude petroleum in the foreign nations of the Western Hemisphere (for use in those foreign nations and for export) is expected to increase from 1,750,000 barrels daily in 1948 to 2,490,000 barrels per day in 1953, and in the Eastern Hemisphere exclusive of Russia from 1,500,000 barrels daily in 1948 to 2,520,000 barrels per day in 1953.

"Although it was beyond the scope of the study to estimate future distribution of this foreign oil between consuming areas of the world," stated the report, "these increases in total foreign production should increase the availability from these sources for consumption in the U. S. In this connection, it is important to note that consumption within the principal foreign oil-producing countries is relatively small, and the largest part of the output of those countries is available for use in other areas."

More Price Increases Occur Despite Hold-Line Efforts

Prices in the petroleum industry have continued under pressure of inflationary forces, and in the latter part of November there was increased possibility of a general crude price advance, as Sinclair Prairie Oil Company raised its postings 35 cents a barrel.

Effective November 24, Sinclair Prairie increased prices by 35 cents in all fields where it purchases, and became the first major company to meet similar increases posted September 28 by Phillips Petroleum Company. Phillips buys in Texas, Oklahoma, Kansas, and Arkansas. Sinclair also buys in those states, and through its affiliate, Sinclair Wyomong Oil Company, it extended the increase into the Rocky Mountain states. Following Sinclair's increases, Premier Oil Refining Company, purchasing crude in the East Texas field, also raised its posting 35 cents. These increases put the top postings of Sinclair, Premier, and Phillips at $3 per barrel.

Other major purchasing companies have resisted the increases initiated by Phillips, and it was indicated that they might continue to do so even after Sinclair met the Phillips prices. At Tulsa after the Sinclair increase, O. C. Schorp, president of The Carter Oil Company, subsidiary of Standard Oil Company (N. J.), stated that his company would not increase its postings.

"In view of the increasingly favorable over-all crude oil supply situation at generally prevailing price levels," stated Schorp, "we see no justification for increases announced by others.

"Our supply position is satisfactory," Schorp continued, "and so long as this continues to be the case, The Carter Oil Company does not plan to change its price postings."

Phillips officials have made several public statements in recent weeks denying that the company contemplated going back to former lower postings and asserting that it intended to maintain its new schedule. The company was reported having some difficulty in obtaining sufficient crude supply before it posted the 35-cent increase. It gave as a main reason for its increase the conviction that the higher prices were necessary to assure adequate development of new crude reserves.

In California there have been increases in crude oil prices and also in products prices during the past month. Effective November 1, Time Oil Company of Los Angeles posted a new schedule for Long Beach and Signal Hill crudes, providing graduated increases based on gasoline and gas-oil yield from the various gravities of oil and involving a maximum increase of 16 cents per barrel. The schedule called for about the same prices as were being paid by some other independent companies, who for several months have been paying premiums above major-company postings. Bonuses of 5 to 15 cents a barrel for crude above 20 gravity have been common in Califoria, it is reported.

On November 12 Standard Oil Company of California increased its posted prices for automotive gasolines by 2/10 cent a gallon, for diesel and heating oils 4/10 cent a gallon, and for fuel oil, 10 cents a barrel. The company explained that the increases were made "to meet the recent general wage increase, as well as rising prices for virtually all purchased supplies."

The California petroleum industry has returned to normal basis of operations, as the strike of West Coast oil workers is in process of settlement, with workers getting only the 12½ cents per hour increase that oil companies offered them before the strike. In the week ended November 13, California's crude production averaged 960,100 barrels daily and its refinery runs of crude average 901,000 barrels per day.

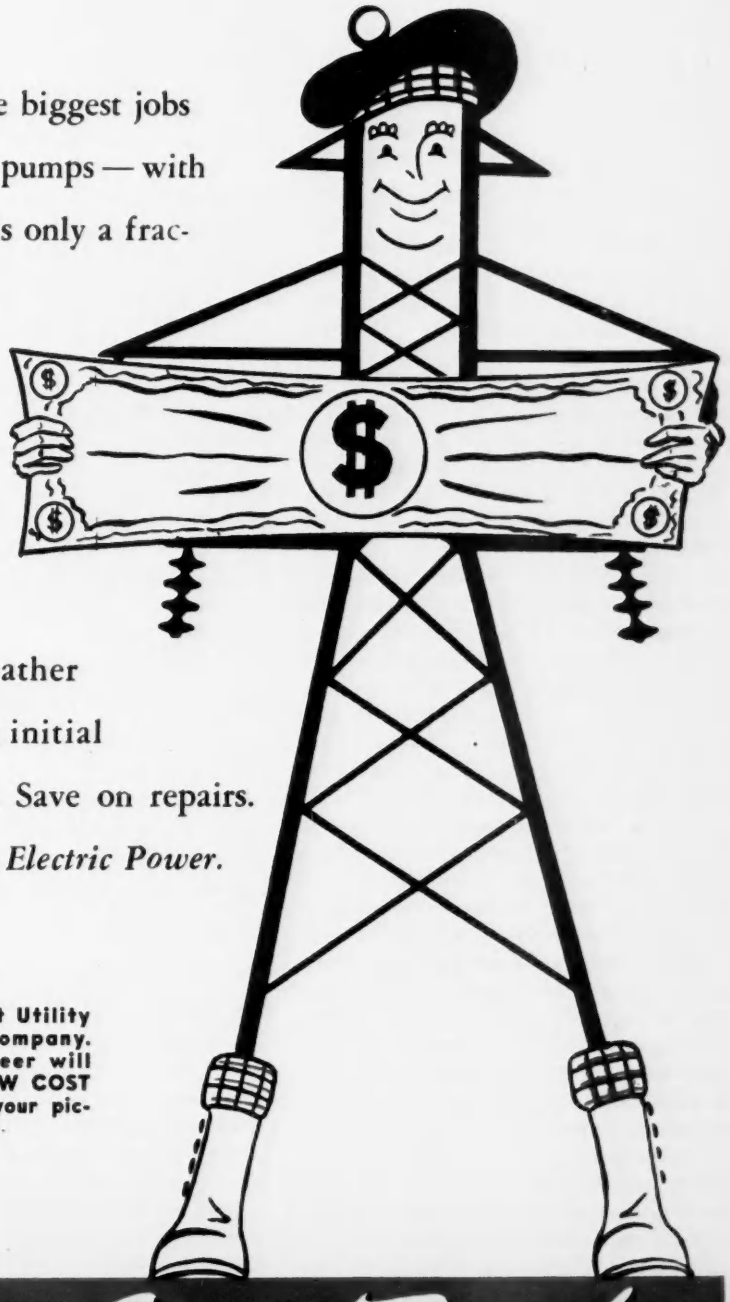
Texas Commission's Power In Shutdowns Challenged

Although a great deal remains to be threshed out in the courts, the recent Railroad Commission order shutting in 16 Texas oil fields for alleged waste of gas opens a new era in state regulation. Litigation arising from the orders will test the powers of the commission to definitely terminate all waste of gas by flaring.

Within a few hours after broad orders had been issued affecting 16 major oil

LCP*

S-T-R-E-T-C-H-E-S
YOUR POWER DOLLAR



LOW COST POWER handles the biggest jobs — pipe lines, refineries, multiple pumps — with trouble-free efficiency. If the job is only a fractional horsepower motor, Utility Electric LOW COST POWER is your best bet, too.... You get all the advantages of low operating, maintenance and labor costs . . . easy portability . . . fast starting in all weather . . . s-l-o-w depreciation. Save on initial cost of power-driven equipment. Save on repairs. *Everything's up* EXCEPT *Utility Electric Power.*

Call your nearest Utility Electric Power Company. The Power Engineer will show you how LOW COST POWER fits into your picture.

Use Utility Electric Power!

PETROLEUM ELECTRIC POWER ASSOCIATION

Box 1498, Oklahoma City, Oklahoma

fields, suits had been filed challenging the powers of the commission. These suits will bring up many points of law which cannot be clarified until they have been settled in the courts, perhaps going all the way up to the Texas and the U. S. Supreme Courts.

Meanwhile, it is reasonably certain there will be no drastic curtailment of Texas crude production because of these orders, in numerous suits testing fundamental powers of the commission, the courts have intervened to assure producers of their rights to operate pending final court decision.

Late in November preliminary hearings were scheduled in which state courts were being asked by producers to grant temporary orders to restrain the commission from enforcing these drastic orders.

The 16 fields included in the list of those to be shut down December 1 had a combined allowable of approximately 400,000 barrels a day. About one-half of this amount is in the Permian Basin, West Texas, and the remainder in the Gulf Coast, Upper and Lower. In issuing the orders, Commission Chairman E. O. Thompson stated that they were essentially waste-prevention orders. He said testimony at a recent hearing showed an ample market for flare gas, and that the commission saw no reason for not requiring that this gas be used for a lawful purpose.

While there will be many legal questions regarding the validity of these orders, the commission has acted with forethought and preparation, and with a confidence drawn from the decision of the Texas Supreme Court in the Seeligson field case. In that decision it was held that the commission had broader powers than those specifically set down in the statutes, and can limit oil production to whatever extent is required to restrict gas withdrawal to that amount which can be legally used. In the 16 fields listed, those wells were exempted which are now making legal use of all casinghead gas produced, but the burden of proof was placed upon the operator.

In the present action the courts will have to decide upon a number of questions which could invalidate the orders. In each of the fields listed it is understood that construction of gas-conserving installations is already under way. The companies are certain to point to the shortage of materials as a major factor responsible for the fact that installations are not yet completed. The very fact that much money has already been spent getting such facilities under way will be pointed to as intent to comply with the letter of the regulations against waste gas. Another technical question to be decided is that relating to legality of using stripped casinghead gas for the manufacture of carbon black. Producers will allege that conservation statutes permit use of casinghead gas for carbon after it has been processed for removal of the heavier fractions. They will no doubt allege that stoppage of the gas used in such plants will in effect amount to confiscation of the plants.

A point mentioned in some petitions is that shutting in of the fields might cause irreparable damage to the reservoir, and that the loss of crude to the public will be more serious than the amount of gas which might be flared between now and the time the various installations are completed.

In the middle of October, at which time the commission had ordered operators of the fields in question to show cause why they should not be shut down, it was predicted that such a shutdown, with consequent loss of nearly 400,000 barrels daily production, would increase the likelihood of a general crude price increase.

The following fields are affected by the orders: Heyser, South Caesar, Conroe, Magnet-Withers, North Withers, Flour Bluff, Tijerina-Canales, La Gloria, all in the Upper and Lower Gulf Coast and Foster, Fullerton, Goldsmith, Levelland, McElroy, Seminole, Slaughter and Wasson in West Texas.

Recognized legal uses are the following: (1) Light or fuel; (2) efficient chemical manufacture other than carbon black; (3) bona fide repressuring or pressure maintenance; (4) extraction of natural gasoline when residue is returned to the horizon.

Commissioner William J. Murray, Jr., said that although he had signed most of the orders, he disagreed with the effective date, thinking that patience in allowing a few more months for compliance would not have placed undue strain on the consuming public, and that the orders might then have been enforced without eliciting legal opposition.

Duncan, Okla., Observes Oil Appreciation Week

Oklahoma oil men were "Kings for a Week" at Duncan, Okla., recently as thousands of Stephens County residents and other Oklahoma state and county officials honored the men who have contributed to the phenomenal development of the oil industry in southern Oklahoma. The occasion was "Oil Appreciation Week," sponsored by the Duncan Chamber of Commerce and boosted by land owners, merchants and business men. Those honored included oil companies and independent oil producers, oil equipment manufacturers, trade associations and other groups affiliated with the oil industry. Purposes of the observance were, first, to express the community's appreciation; second, to educate and inform the public of the favorable development, present extent and importance of the oil industry to that section of Oklahoma; and third, to show the oil industry that they are welcome in Duncan and southern Oklahoma.

Premature Abandonment of Stripper Wells Continues

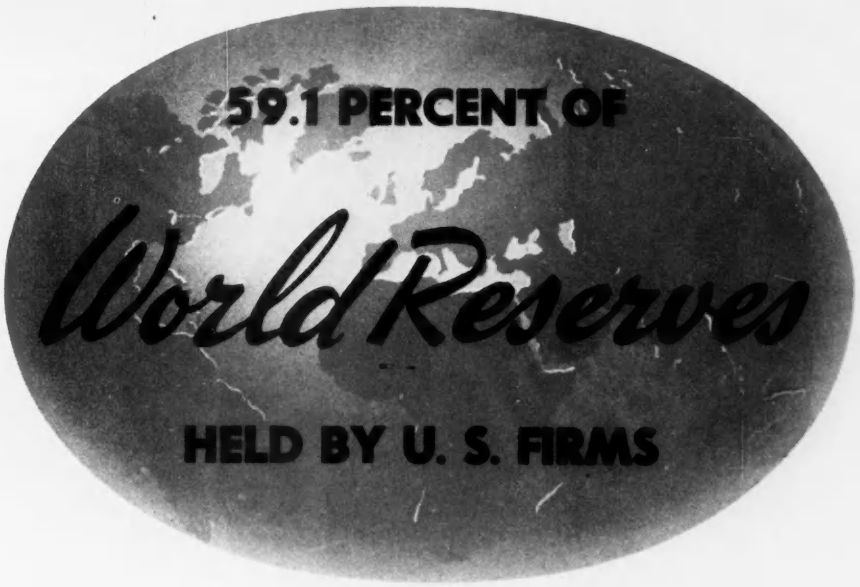
Premature abandonment of stripper wells continues at a high rate in the Mid-Continent area where, according to the National Oil Conservation Committee, the high prices being offered for used casing are attracting many marginal well owners who feel that they can do better by scrapping their leases than by continuing to produce oil. The NOCC also feels that failure of the majority of oil purchasers to meet the 35-cent-per-barrel increase announced in September by Phillips Petroleum Company is also a contributing factor to the premature abandonments.

Rumors are current that the new Congress may be asked to enact legislation which would prevent the premature abandonment of stripper wells, although how this can be effected is anybody's guess. The NOCC has consistently advocated a conservation payment for marginal wells, but officials of the organization say they are opposed to any form of federal control. Any legislation affecting stripper areas is considered a wedge by federal bureaucracy which could conceivably be widened to include other phases of the industry.

Ruling Expected on Taxation Of Unitized Oil, Gas Fields

Look for the Department of Internal Revenue to issue a formal income tax ruling on the controversial subject of imposing tax at corporate rates on oil and gas field unitized operations. Heretofore some of these operations have been taxed as associations at the corporation rates and distributions made to the unit operators treated as dividends.

Under the proposed ruling, if the unit group is organized to function as one unit to develop, produce, market and sell the products without the right of each member of the group to receive the production in kind, then the unit will be considered as an association and taxable at corporate rates. However, if the operations are conducted jointly, each operator having an undivided interest in the whole unit with the right to receive his proportionate share of the production in kind, then the unit group may be considered as a joint venture, and each owner of the undivided portion of the unit taxed upon his net income from the operation of his undivided interest in the unit.



59.1 PERCENT OF World Reserves HELD BY U. S. FIRMS

By L. J. LOGAN
Associate Editor

ALMOST three-fourths of the world's proved petroleum reserves are held by about 35 companies, and about 45 percent of world reserves are deposits outside the U. S. that are held by ten companies which include 6 U. S. concerns, 2 British-Dutch companies, 1 French company, and 1 Mexican company. The foreign reserves of six U. S. companies and two British-Dutch companies constitute 41.9 percent of world reserves, whereas all reserves lying within U. S. borders are only 38.1 percent of world reserves. Sharing in U. S. domestic reserves to the extent of 69.5 percent are 32 companies, while the other 30.5 percent of domestic reserves are in the hands of thousands of smaller companies and operators.

These are a few of the facts about the distribution of the world's petroleum reserves among the different oil companies, as revealed in tabulations and charts presented herewith.

Another important fact here emphasized is the relative scarcity of reserves within U. S. borders as compared with the more abundant reserves in foreign fields. The U. S. held within its boundaries only 38.1 percent of proved world reserves at the beginning of 1948, although its production in 1947 was 62 percent of world output. In this circumstance it is natural that there should be considerable concern over whether or not domestic reserves can continue to supply U. S. requirements. There are some oil men who remain confident that domestic reserves can be expanded greatly and made to fill the nation's needs for some years. But some foreign areas are remarkably rich in petroleum, and it appears that the U. S. can avoid depending upon those foreign reserves only by sharply stepping up discovery of new domestic reserves and by achieving great efficiency and economy in development of domestic sources.

Meanwhile, some of the larger U. S. companies are carrying insurance against shortage of domestic supply by developing important reserves in other countries, although these foreign holdings currently are being used principally for supplying foreign markets. In the first eight months of 1948 the U. S. imported about 25 million barrels more than it exported, and in August imports exceeded exports by about 2½ million barrels.

While U. S. domestic reserves constitute 38.1 percent of world reserves, the foreign reserves of six U. S. companies represent 21.0 percent of the world total, making a total of 59.1 percent of world reserves held by U. S. companies. This combined holding of domestic and foreign reserves puts U. S. holdings closely in line with the U. S. consumption of over 60 percent of world petroleum output.

Proved world reserves as of the beginning of 1948 are here estimated at 64,937,010,000 barrels, including 24,741,660,000 barrels of crude and natural gas liquids in the U. S. and 40,195,350,000 barrels in other countries. In addition to owning virtually all the domestic reserves, U. S. companies hold approximately 13,624,250,000 barrels of the estimated reserves in foreign countries, which amount is 33.9 percent of total foreign reserves and 21.0 percent of world reserves. Together, the domestic U. S. reserves and the foreign reserves of U. S. companies amount to 38,365,910,000 barrels, or 59.1 percent of the world total. Of this total of American-held reserves, domestic reserves are 64.5 percent and foreign reserves are 35.5 percent. There foreign reserves are held by half a dozen U. S. companies.

While U. S. companies control one-third of all foreign reserves, nearly the same amount, or another one-third of total foreign reserves, is held by British and Dutch interests through two large companies, Anglo-Iranian Oil Company (world's largest holder of reserves) and the Royal Dutch-Shell Group. These two large concerns, the former operating mainly in the Middle East and the latter worldwide, are here estimated to have proved reserves of 13,575,700,000 barrels, not including Shell holdings in the U. S. through Shell Union Oil Corporation. This amount is 33.8 percent of the total reserves outside the U. S. and 20.9 percent of world reserves. Through some smaller companies, the British and Dutch people also hold limited additional reserves, and by virtue of equaling Americans in ownership of foreign reserves, they are second to Americans in control of world reserves. Domestic and foreign reserves of all U. S. companies and the reserves of Anglo-Iranian and Royal Dutch-Shell companies together constitute 80 percent of world reserves.

The French concern, Compagnie Francaise des Petroles, holds interests in the Middle East that give it control of 2.0 percent of world reserves. These reserves are in Iraq and Qatar, owned through an interest of 23.75 percent in Iraq Petroleum Company.

Mexico's government-owned oil company, Petroleos Mexicanos, has about 1.6 percent of world reserves in controlling the estimated 1,058,000,000 barrels of proved reserves in Mexico.

The reserves of Compagnie Francaise, Petroleos Mexicanos, Anglo-Iranian,

fields, suits had been filed challenging the powers of the commission. These suits will bring up many points of law which cannot be clarified until they have been settled in the courts, perhaps going all the way up to the Texas and the U. S. Supreme Courts.

Meanwhile, it is reasonably certain there will be no drastic curtailment of Texas crude production because of these orders, in numerous suits testing fundamental powers of the commission, the courts have intervened to assure producers of their rights to operate pending final court decision.

Late in November preliminary hearings were scheduled in which state courts were being asked by producers to grant temporary orders to restrain the commission from enforcing these drastic orders.

The 16 fields included in the list of those to be shut down December 1 had a combined allowable of approximately 400,000 barrels a day. About one-half of this amount is in the Permian Basin, West Texas, and the remainder in the Gulf Coast, Upper and Lower. In issuing the orders, Commission Chairman E. O. Thompson stated that they were essentially waste-prevention orders. He said testimony at a recent hearing showed an ample market for flare gas, and that the commission saw no reason for not requiring that this gas be used for a lawful purpose.

While there will be many legal questions regarding the validity of these orders, the commission has acted with forethought and preparation, and with a confidence drawn from the decision of the Texas Supreme Court in the Seeligson field case. In that decision it was held that the commission had broader powers than those specifically set down in the statutes, and can limit oil production to whatever extent is required to restrict gas withdrawal to that amount which can be legally used. In the 16 fields listed, those wells were exempted which are now making legal use of all casinghead gas produced, but the burden of proof was placed upon the operator.

In the present action the courts will have to decide upon a number of questions which could invalidate the orders. In each of the fields listed it is understood that construction of gas-conserving installations is already under way. The companies are certain to point to the shortage of materials as a major factor responsible for the fact that installations are not yet completed. The very fact that much money has already been spent getting such facilities under way will be pointed to as intent to comply with the letter of the regulations against waste gas. Another technical question to be decided is that relating to legality of using stripped casinghead gas for the manufacture of carbon black. Producers will allege that conservation statutes permit use of casinghead gas for carbon after it has been processed for removal of the heavier fractions. They will no doubt allege that stoppage of the gas used in such plants will in effect amount to confiscation of the plants.

A point mentioned in some petitions is that shutting in of the fields might cause irreparable damage to the reservoir, and that the loss of crude to the public will be more serious than the amount of gas which might be flared between now and the time the various installations are completed.

In the middle of October, at which time the commission had ordered operators of the fields in question to show cause why they should not be shut down, it was predicted that such a shutdown, with consequent loss of nearly 400,000 barrels daily production, would increase the likelihood of a general crude price increase.

The following fields are affected by the orders: Heyser, South Caesar, Conroe, Magnet-Withers, North Withers, Flour Bluff, Tijerina-Canales, La Gloria, all in the Upper and Lower Gulf Coast and Foster, Fullerton, Goldsmith, Levelland, McElroy, Seminole, Slaughter and Wasson in West Texas.

Recognized legal uses are the following: (1) Light or fuel; (2) efficient chemical manufacture other than carbon black; (3) bona fide repressuring or pressure maintenance; (4) extraction of natural gasoline when residue is returned to the horizon.

Commissioner William J. Murray, Jr., said that although he had signed most of the orders, he disagreed with the effective date, thinking that patience in allowing a few more months for compliance would not have placed undue strain on the consuming public, and that the orders might then have been enforced without eliciting legal opposition.

Duncan, Okla., Observes Oil Appreciation Week

Oklahoma oil men were "Kings for a Week" at Duncan, Okla., recently as thousands of Stephens County residents and other Oklahoma state and county officials honored the men who have contributed to the phenomenal development of the oil industry in southern Oklahoma. The occasion was "Oil Appreciation Week," sponsored by the Duncan Chamber of Commerce and boosted by land owners, merchants and business men. Those honored included oil companies and independent oil producers, oil equipment manufacturers, trade associations and other groups affiliated with the oil industry. Purposes of the observance were, first, to express the community's appreciation; second, to educate and inform the public of the favorable development, present extent and importance of the oil industry to that section of Oklahoma; and third, to show the oil industry that they are welcome in Duncan and southern Oklahoma.

Premature Abandonment of Stripper Wells Continues

Premature abandonment of stripper wells continues at a high rate in the Mid-Continent area where, according to the National Oil Conservation Committee, the high prices being offered for used casing are attracting many marginal well owners who feel that they can do better by scrapping their leases than by continuing to produce oil. The NOCC also feels that failure of the majority of oil purchasers to meet the 35-cent-per-barrel increase announced in September by Phillips Petroleum Company is also a contributing factor to the premature abandonments.

Rumors are current that the new Congress may be asked to enact legislation which would prevent the premature abandonment of stripper wells, although how this can be effected is anybody's guess. The NOCC has consistently advocated a conservation payment for marginal wells, but officials of the organization say they are opposed to any form of federal control. Any legislation affecting stripper areas is considered a wedge by federal bureaucracy which could conceivably be widened to include other phases of the industry.

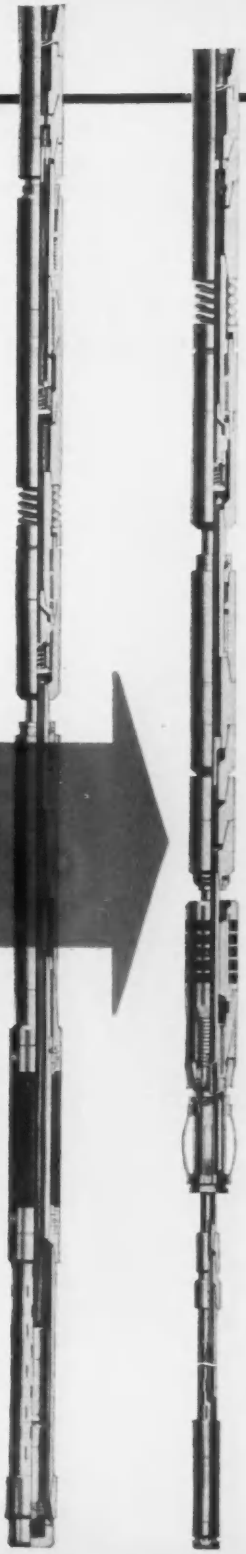
Ruling Expected on Taxation Of Unitized Oil, Gas Fields

Look for the Department of Internal Revenue to issue a formal income tax ruling on the controversial subject of imposing tax at corporate rates on oil and gas field unitized operations. Heretofore some of these operations have been taxed as associations at the corporation rates and distributions made to the unit operators treated as dividends.

Under the proposed ruling, if the unit group is organized to function as one unit to develop, produce, market and sell the products without the right of each member of the group to receive the production in kind, then the unit will be considered as an association and taxable at corporate rates. However, if the operations are conducted jointly, each operator having an undivided interest in the whole unit with the right to receive his proportionate share of the production in kind, then the unit group may be considered as a joint venture, and each owner of the undivided portion of the unit taxed upon his net income from the operation of his undivided interest in the unit.

FORMATION AND JOHNSTON CASING TESTING

Johnston TESTS THE DEEP ONES!



Inside Casing . . . .

Johnston got the story in the world's deepest well in Oklahoma. Working below 17,000 feet inside 7" casing, the Johnston Casing Tester obtained results on every run.

In Open Hole . . . .

13,514 feet of open hole in Louisiana was no problem for Johnston Formation Tester. It functioned perfectly and released easily after test was completed.

Johnston Testers will get the information in your wells too, whether they're deep or shallow, open or cased. To be sure when you test, be sure to call "Johnston" when it's time to test. Experienced representatives are maintained in all active areas, ready to serve you twenty-four hours a day.

JOHNSTON OIL FIELD SERVICE CORPORATION
5702 Navigation Blvd., Houston, Texas
"SERVICING MID-CONTINENT AND GULF COAST AREAS"
Abilene, Alice, Cisco, Graham, Throckmorton, Tyler, Victoria, Wichita Falls, Texas; Lake Charles Louisiana; Magnolia, Arkansas; Laurel, Natchez, Mississippi; Chickasha, Oklahoma; New Harmony, Indiana; Fairfield, Illinois.

M. O. JOHNSTON OIL FIELD SERVICE CORPORATION
3035 Andrita Street, Los Angeles 41, California
"SERVICING CALIFORNIA—PERMIAN BASIN—ROCKY MOUNTAIN AREAS"
Bakersfield, Avenal, Sacramento, Ventura, Santa Maria, Calif.; Odessa, San Angelo, Texas; Casper, Wyo.; Hobbs, N. M.

M. O. JOHNSTON OIL FIELD SERVICE COMPANY
"EXCLUSIVE EXPORT SALES" 3035 Andrita Street, Los Angeles 41, California

FORMATION AND JOHNSTON CASING TESTING

Drillers Prefer the BREWSTER N-7 *Team* .....

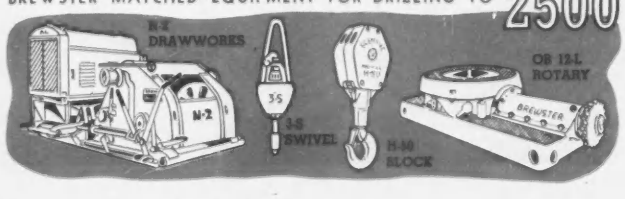
THE N-7 DRAWWORKS..

The Brewster N-7 Team has been designed together—and perfectly matched—to give you maximum drilling efficiency and economy. The N-7 Drawworks is conservatively rated for drilling to 7500′ with 4½″ pipe. With twelve line speeds and six rotary speeds, it is compact and easily portable. Entirely air-controlled from centralized control panel. For full details write now for N-7 Catalog WO 107.

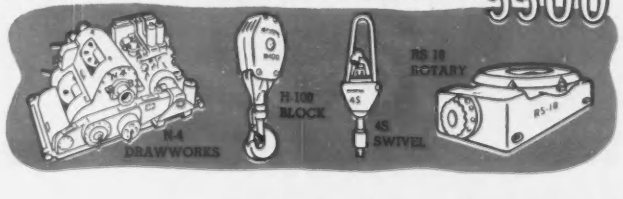
For information about the N-2 Team (for 2500′ drilling) ask for Catalog WO 108; about the N-4 Team (for 4500′-5500′ drilling) ask for Catalog WO 113.

OTHER BREWSTER DRILLING TEAMS

BREWSTER MATCHED EQUIPMENT FOR DRILLING TO 2500′



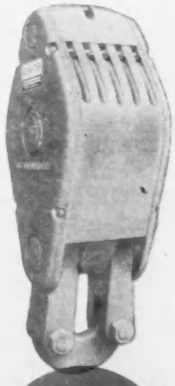
BREWSTER MATCHED EQUIPMENT FOR DRILLING TO 5500′



..... for drilling ... WITH MATCHED EQUIPMENT to 7500'

RS-18 OILBATH
ROTARY

Tough, heat treated spiral bevel gears. Rugged box type frame with bed and skids integral. Full 18" table opening. Three large oil reservoirs. Quick, positive table locks.



200 TON
BLOCK

Perfectly balanced for straight fall. Streamlined — no dangerous projections to hang up. Straight line travel without weave or wobble. Double-row tapered roller bearings on each sheave.

6-S OILBATH
SWIVEL

Features functional design with minimum parts. Streamlined for safety. High capacity bearings with positive, continuous lubrication and cooling. Maximum strength with minimum weight.

THE BREWSTER CO., INC.

Manufacturers of Drilling Equipment

Since 1910

SHREVEPORT, LOUISIANA, U. S. A.

BREWSTER MATCHED Drilling Equipment

SOLD BY: APEX EQUIPMENT CO. • BOVAIRD SUPPLY CO.
INDUSTRIAL SUPPLY CO. • MURRAY BROOKS, INC.
REAMS SUPPLY CO. • IN CANADA: HALEY SUPPLY CO.
EXPORT SALES: BAIRD SUPPLY CO., 420 LEXINGTON AVE., NEW YORK 17, N. Y.

Looking Ahead

● FOREIGN CRUDE PETROLEUM production outside Russia, estimated at 3,250,-000 barrels daily in 1948, is estimated by API committee on long term availabiliy of petroleum to increase in 1949 to 3,580,000 barrels daily, in 1950 to 3,900,000, in 1951 to 4,330,000, in 1952 to 4,710,000, and in 1953 to 5,010,000 daily. These figures include for Western Hemisphere outside U. S. in 1948 average of 1,750,000 daily and increase in 1949 to 1,900,000, in 1950 to 2,060,000, in 1951 to 2,250,000, in 1952 to 2,450,-000 daily. Eastern Hemisphere except Russia will average 1½ million daily in 1948, rise in 1949 to 1,680,000, in 1950 to 1,840,000, in 1951 to 2,080,000, in 1952 to 2,260,000, and in 1953 to 2,520,000.

● U. S. SUPPLIES of natural resources will receive much attention from federal government during the next several years. Oil will be very much at the top of the list. There will be much talk about the country running out of oil. Development of a synthetic petroleum industry based on shale and coal likely will be advocated as "insurance" against such a possibility.

● ARMY ENGINEERS are reported looking into a plan for installing ten new oil shale plants at Rifle, Colo., and a pipe line system to connect the oil shale deposits with the Pacific Coast.

● THE SUPPLY PICTURE for farm fuels and lubes looks good for 1949. During the past ten months the oil industry has met every demand of an exceptionally heavy season and Midwest refiners report that they also have been able to accumulate reserve stocks with good prospects of adding to these against anticipated future heavy demands.

● FURTHER INCREASE in gasoline demand is indicated by forecast of C.E. Wilson, president of General Motors Corporation, that it will be two years or longer before new automobiles will have been made in sufficient numbers to overcome shortage.

● TANKERS NOW available and new ones to be delivered will closely balance world transportation needs over the next few years if there are no extraordinary world developments and if projected Middle East pipe lines are completed on schedule. This assurance is given by Association of American Ship Owners and also by M. G. Gamble, general manager of marine department of Standard Oil Company (N. J.). With benefit of tankers released by U. S. government, now back in service, there are now 60 to 70 surplus tankers tied up for lack of business, and it is highly improbable that this winter will bring recurrence of last winter's tanker shortage.

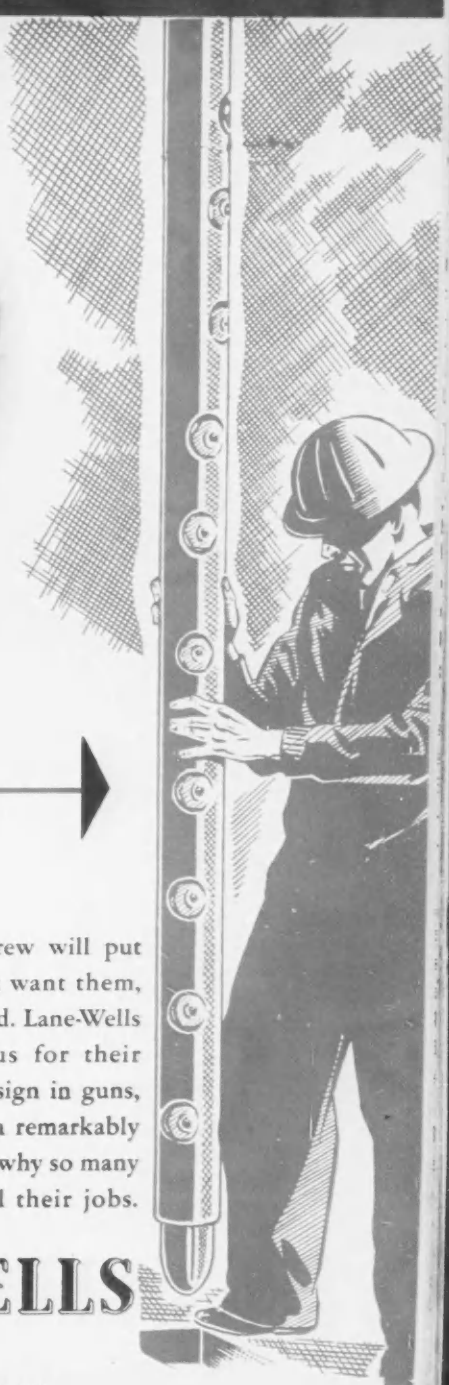
● AN 11-YEAR-OLD oil industry record will be broken by the end of 1948 when compilations will show that nearly 39,000 new wells were drilled. Drillers made 1937 their banner year by completing more than 35,000 wells. The footage drilled mark of 113 million was set in 1947, but that too will yield to this year's probable 134 million feet.

● STEEL COMPANIES are conducting intensive tests and research work on concentration of low-grade iron ores. U. S. is running short of high-grade ore and this scarcity could become permanent bottleneck that would have serious effects on oil and other industries.

● KANSAS MAY enact a tax on oil and gas to help provide funds to increase the pay of school teachers and provide enlarged educational facilities for the state. Just what type of tax may be imposed has not been decided but there is considerable opposition against a severance tax with the executive branch of the state as well as the legislative research committee opposed to it.

WORLD OIL

CURRENT OUTLOOK SECTION



THESE TWO THINGS HAVE A LOT IN COMMON

And that is—SELECTIVITY. Just as a concert pianist can play any note, or any combination of notes, anywhere on the keyboard, just as he desires, the shooter on a Lane-Wells gun perforating crew can fire any shot, any combination of shots, just exactly when and where he wants them. But the most important similarity is this—the pianist doesn't strike the keys as he wants, but as the composer's score directs. And when it comes to gun-perforating, *you* are the composer on a Lane-Wells job. You write the music, we play it. In other words, *you* lay out the perforation density your job demands (and it can be as varied as you please), and the thoroughly-trained Lane-Wells crew will put the shots just exactly where you want them, spaced exactly as you have specified. Lane-Wells depth measurements are famous for their accuracy; Lane-Wells balanced design in guns, bullets and powder has hung up a remarkably fine success record—more reasons why so many operators use Lane-Wells on all their jobs.

LANE WELLS COMPANY

LOS ANGELES • HOUSTON • OKLAHOMA CITY

24-HOUR SERVICE *General Offices, Export Offices and Plant* 45 BRANCHES

5610 S. SOTO ST., LOS ANGELES 11, CALIFORNIA

EXTRA TIME . . .
FOR EXTRA SAFETY

with easy-pumping, hard-setting **UNAFLO**

When things go wrong below, you need help. And you get it . . . from Unaflo . . . the oil-well cement with the delayed, the postponed, the *retarded* set.

Because of its *retarded* set, Unaflo cement does not stiffen prematurely. It stays fluid and pumpable during the entire period of retardation . . . even at high temperatures and pressures and with heavy slurries.

With its *retarded* set, Unaflo puts you in partnership with time. It gives you ample time, during normal operations, to get cement in place; *extra time*, in emergencies, to correct the causes of trouble. When it finally hardens, Unaflo forms a solid, impervious seal. No wonder oil-men say, "It's great to know you're cementing with Unaflo."

Send for further information.

WACO • KANSAS CITY • BIRMINGHAM
CHICAGO • NEW YORK

Export Distributor:
United States Steel Export Company, New York

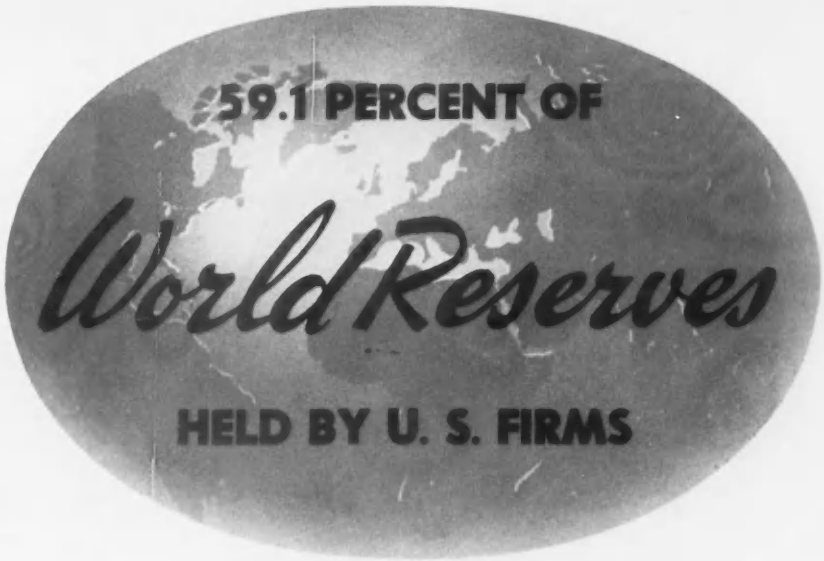
WO-U-87

UNIVERSAL ATLAS CEMENT COMPANY

OIL-FIELD CEMENTS

Unaflo *Retarded* Oil-Well Cement
Resistant to Sulfate Waters
Atlas Portland Cement—Type I
Atlas Portland Cement—Type II
Resistant to Sulfate Waters
Atlas High-Early Cement—Type III

"THE THEATRE GUILD ON THE AIR"—*Sponsored by U. S. Steel Subsidiaries—Sunday Evenings—ABC Network*



By L. J. LOGAN
Associate Editor

ALMOST three-fourths of the world's proved petroleum reserves are held by about 35 companies, and about 45 percent of world reserves are deposits outside the U. S. that are held by ten companies which include 6 U. S. concerns, 2 British-Dutch companies, 1 French company, and 1 Mexican company. The foreign reserves of six U. S. companies and two British-Dutch companies constitute 41.9 percent of world reserves, whereas all reserves lying within U. S. borders are only 38.1 percent of world reserves. Sharing in U. S. domestic reserves to the extent of 69.5 percent are 32 companies, while the other 30.5 percent of domestic reserves are in the hands of thousands of smaller companies and operators.

These are a few of the facts about the distribution of the world's petroleum reserves among the different oil companies, as revealed in tabulations and charts presented herewith.

Another important fact here emphasized is the relative scarcity of reserves within U. S. borders as compared with the more abundant reserves in foreign fields. The U. S. held within its boundaries only 38.1 percent of proved world reserves at the beginning of 1948, although its production in 1947 was 62 percent of world output. In this circumstance it is natural that there should be considerable concern over whether or not domestic reserves can continue to supply U. S. requirements. There are some oil men who remain confident that domestic reserves can be expanded greatly and made to fill the nation's needs for some years. But some foreign areas are remarkably rich in petroleum, and it appears that the U. S. can avoid depending upon those foreign reserves only by sharply stepping up discovery of new domestic reserves and by achieving great efficiency and economy in development of domestic sources.

Meanwhile, some of the larger U. S. companies are carrying insurance against shortage of domestic supply by developing important reserves in other countries, although these foreign holdings currently are being used principally for supplying foreign markets. In the first eight months of 1948 the U. S. imported about 25 million barrels more than it exported, and in August imports exceeded exports by about 2½ million barrels.

While U. S. domestic reserves constitute 38.1 percent of world reserves, the foreign reserves of six U. S. companies represent 21.0 percent of the world total, making a total of 59.1 percent of world reserves held by U. S. companies. This combined holding of domestic and foreign reserves puts U. S. holdings closely in line with the U. S. consumption of over 60 percent of world petroleum output.

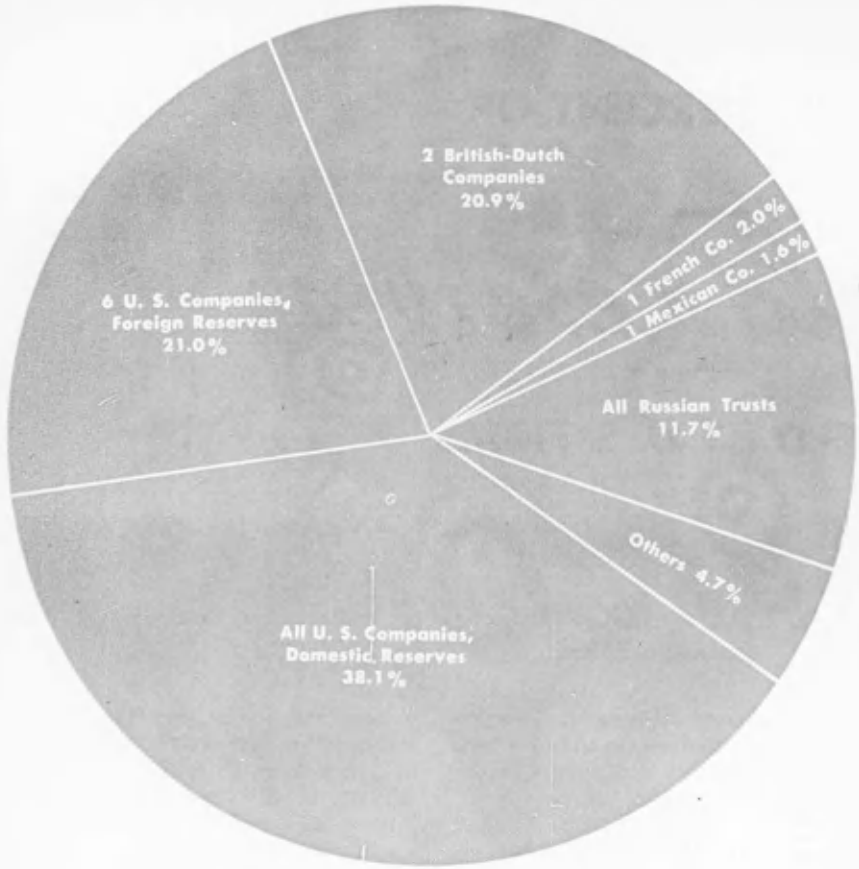
Proved world reserves as of the beginning of 1948 are here estimated at 64,937,010,000 barrels, including 24,741,660,000 barrels of crude and natural gas liquids in the U. S. and 40,195,350,000 barrels in other countries. In addition to owning virtually all the domestic reserves, U. S. companies hold approximately 13,624,250,000 barrels of the estimated reserves in foreign countries, which amount is 33.9 percent of total foreign reserves and 21.0 percent of world reserves. Together, the domestic U. S. reserves and the foreign reserves of U. S. companies amount to 38,365,910,000 barrels, or 59.1 percent of the world total. Of this total of American-held reserves, domestic reserves are 64.5 percent and foreign reserves are 35.5 percent. There foreign reserves are held by half a dozen U. S. companies.

While U. S. companies control one-third of all foreign reserves, nearly the same amount, or another one-third of total foreign reserves, is held by British and Dutch interests through two large companies, Anglo-Iranian Oil Company (world's largest holder of reserves) and the Royal Dutch-Shell Group. These two large concerns, the former operating mainly in the Middle East and the latter worldwide, are here estimated to have proved reserves of 13,575,700,000 barrels, not including Shell holdings in the U. S. through Shell Union Oil Corporation. This amount is 33.8 percent of the total reserves outside the U. S. and 20.9 percent of world reserves. Through some smaller companies, the British and Dutch people also hold limited additional reserves, and by virtue of equaling Americans in ownership of foreign reserves, they are second to Americans in control of world reserves. Domestic and foreign reserves of all U. S. companies and the reserves of Anglo-Iranian and Royal Dutch-Shell companies together constitute 80 percent of world reserves.

The French concern, Compagnie Francaise des Petroles, holds interests in the Middle East that give it control of 2.0 percent of world reserves. These reserves are in Iraq and Qatar, owned through an interest of 23.75 percent in Iraq Petroleum Company.

Mexico's government-owned oil company, Petroleos Mexicanos, has about 1.6 percent of world reserves in controlling the estimated 1,058,000,000 barrels of proved reserves in Mexico.

The reserves of Compagnie Francaise, Petroleos Mexicanos, Anglo-Iranian,


2 British-Dutch Companies 20.9%
1 French Co. 2.0%
1 Mexican Co. 1.6%
All Russian Trusts 11.7%
Others 4.7%
All U. S. Companies, Domestic Reserves 38.1%
6 U. S. Companies, Foreign Reserves 21.0%

WORLD RESERVES BY COMPANIES

Royal Dutch-Shell, and all U. S. companies, added together, are 83.6 percent of world reserves. This is the bulk of reserves outside Russia. Soviet government trusts control an estimated 7,590,000,000 barrels of reserves in Europe and Asia, equivalent to 11.7 percent of world reserves.

The remaining 3,041,150,000 barrels of world reserves, 4.7 percent of the world total, comprises the reserves of all foreign companies and governments except the British-Dutch, French, Mexican, and Russian companies or trusts mentioned above.

The estimate of world reserves used here is conservative, employing lower figures than are sometimes used for Middle East reserves. For the Middle East, this estimate allows approximately 19,500,000 barrels of acually *proved* reserves and does not include the additional *indicated* reserves of about 10 billion barrels sometimes credited to fields that have been discovered but not yet fully explored. Those additional *indicated* reserves are almost equally divided in ownership by American companies and British-Dutch interests.

Anglo-Iranian Oil Company, the world's largest owner of reserves, is a British concern, owned 52½ percent by the British government, 25 percent by Burmah Oil Company, Ltd., and 22½ percent by individuals. Its reserves are here estimated at 9,188,450,000 barrels, equivalent to 14.1 percent of world reserves and 22.9 percent of total reserves outside the United States.

Owned by British and Dutch interests, the affiliated concerns comprising the Royal Dutch-Shell Group rank third among all companies in ownership of reserves. Including the U. S. affiliate, Shell Union Oil Company, this combine

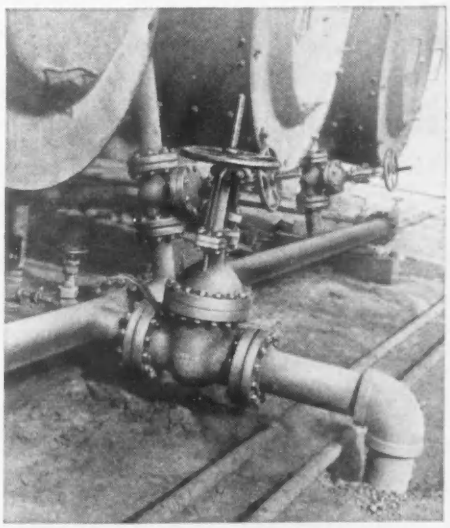
Estimated Petroleum Reserves Held by Several Outstanding Foreign Companies and Comparison with Reserves of All U. S. Companies
(Data estimated by WORLD OIL, with aid of various sources.)
(THOUSANDS OF BARRELS)

ALL COMPANIES	
World Reserves (incl. U.S. natural gas liquids)	64,937,010
U. S. Reserves (incl. natural gas liquids)	24,741,660
(Percent of world)	38.1
Foreign Reserves	40,195,350
(Percent of world)	61.9
U. S. COMPANIES	
(For individual company data on 32 U. S. companies see separate table)	
All U. S. Companies' Total Reserve (incl. Shell Union)	38,365,910
(Percent of world)	59.1
U. S. Companies' Domestic Reserves	24,741,660
(Percent of U. S. Co. total)	64.5
(Percent of world total)	38.1
U. S. Companies' Foreign Reserves	13,624,250
(Percent of U. S. Co. total)	35.5
(Percent of world total)	21.0
(Percent of foreign total)	33.9
BRITISH-DUTCH COMPANIES	
Anglo-Iranian Oil Co. (British Govt. 52½%, Burmah Oil Co. 25%, Individuals 22½%, Total Reserves	9,188,450
(Percent of world Reserves)	14.1
(Percent of Reserves outside U. S.)	22.9
England	7,200
Iran	5,625,000
Iraq (23.75% int. in Iraq. Pet. Co.)	1,187,500
Qatar (23.75% int. in Iraq Pet. Co.)	118,750
Kuwait (50% int. with Gulf Oil 50%)	2,250,000
Royal Dutch-Shell Group excl. Shell Union of U. S. total reserves	4,387,250
(Percent of world reserves)	6.8
(Percent of Reserves outside U. S.)	10.9
Iraq (23.75% int. in Iraq Pet Co.)	1,187,500
Qatar (23.75% int. in Iraq Pet. Co.)	118,750
Egypt	141,000
Austria	20,000
Roumania	150,000
Burma	100,000
India	25,000
British Borneo	200,000
Netherlands India	525,000
Canada	75,000
Argentina	55,000
Colombia	75,000
Ecuador	20,000
Peru	45,000
Venezuela	1,650,000
Royal Dutch-Shell Group, incl. U. S. reserves through Shell Union	5,187,250
U. S. reserves (Shell Union Oil Co. reserves)	800,000
(Percent of world Reserves)	8.0
FRENCH COMPANY	
Compagnie Francaise des Petroles	1,306,250
(Percent of world Reserves)	2.0
(Percent of Reserves outside U. S.)	3.2
Iraq (23.75% int. in Iraq Pet. Co.)	1,187,500
Qatar (23.75% int. in Iraq Pet. Co.)	118,750
MEXICAN COMPANY	
Petroles Mexicanos (Govt. company)	1,058,000
(Percent of world Reserves)	1.6
(Percent of Reserves outside U. S.)	2.6
TOTAL OF ABOVE COMPANIES	
Total all U. S. companies, Anglo-Iranian, Royal Dutch-Shell, Compagnie Francaise, and Petroles Mexicanos	54,305,860
(Percent of world Reserves)	83.6
RUSSIAN TRUSTS	
All Russian govt. trusts, incl. Sakhalin	7,590,000
(Percent of world Reserves)	11.7
(Percent of Reserves outside U. S.)	18.9
OTHER FOREIGN COMPANIES	
All foreign companies except the above listed British-Dutch, French, Mexican, and Russian companies, total Reserves	3,041,150
(Percent of world Reserves)	4.7
(Percent of Reserves outside U. S.)	7.6

For complete selection . . . better piping

. . . get everything from CRANE

ONE
SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY

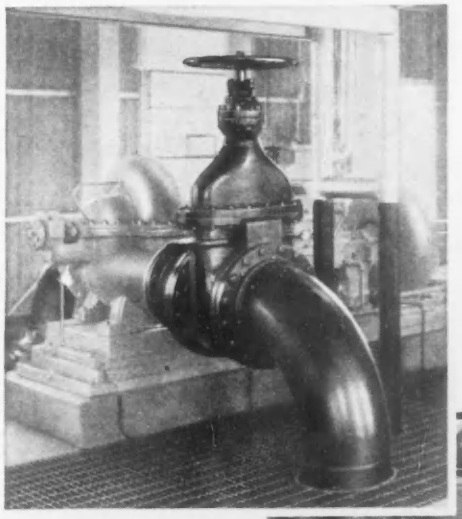


BOILER STEAM MANIFOLD *on a record depth oil well, equipped with Crane 4-in. steel valves.*

That way you can't go wrong. For when you get "everything from Crane," you get unequalled selection from the world's most complete line of quality piping equipment. At your finger tips—in **One Catalog**—you'll find whatever you need in valves, fittings, pipe line accessories and pipe. **One Order** to your local Crane Branch or Wholesaler covers every item—in brass, iron, steel or corrosion-resistant alloy materials.

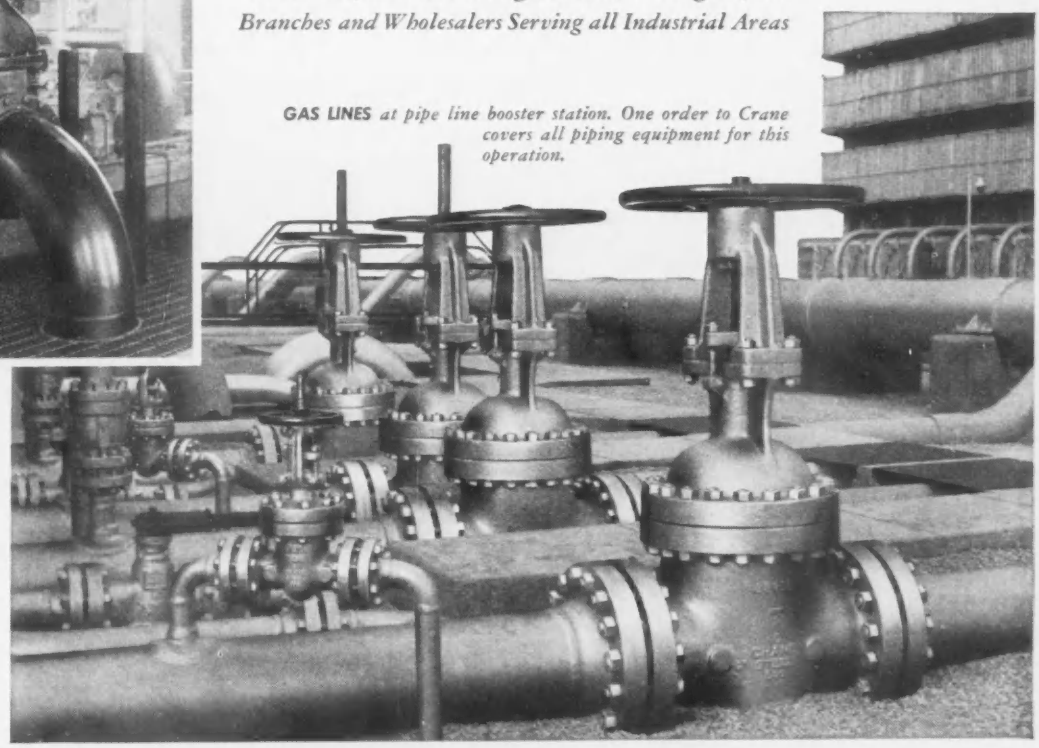
To standardize on this **One Source of Supply** brings you the piping you want—when you want it; simplifies all piping procedures, from design to erection to maintenance. **One Responsibility** for materials delivered to the job helps assure you better installations, avoids unnecessary delays. **High Quality**—Crane Quality—in every item certifies uniform efficiency throughout every part of every piping system.

Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving all Industrial Areas



WATER CIRCULATING PUMP *in natural gasoline plant showing Crane Standard Iron Body Wedge Gate Valve, one of a complete line.*

GAS LINES *at pipe line booster station. One order to Crane covers all piping equipment for this operation.*



EVERYTHING FROM . . .

VALVES
FITTINGS
PIPE

CRANE

PLUMBING
AND
HEATING

FOR EVERY PIPING SYSTEM

holds reserves of 5,187,250,000 barrels, representing 8 percent of world reserves. Exclusive of Shell Union the group holds reserves of 4,387,250,000 barrels, representing 6.8 percent of world reserves and 10.9 percent of reserves outside the U. S.

Crowding Anglo-Iranian for first place and unchallenged in second place is Standard Oil Company (N. J.), No. 1 owner of reserves among U. S. companies. Its reserves are here estimated at 8,950,125,000 barrels, including the 30 percent share it is purchasing in Arabian American Oil Company and thereby in Saudia Arabian reserves. This total includes only Standard's 72 percent interest in Humble Oil & Refining Company in the U. S. and its 93 percent interest in Creole Petroleum Corporation in Venezuela. If all of Humble's and Creole's reserves are included, Standard of New Jersey and its affiliates are found to hold reserves totaling 9,916,125,000 barrels, or more than those of Anglo-Iranian. The lower total of 8,950,125,000 barrels for Standard of New Jersey, excluding minority interests in Humble and Creole, represents 13.8 percent of world reserves. This percentage is closely in line with the company's participation in world production and refining.

Fourth largest owner of reserves is Standard of New Jersey's Venezuelan subsidiary, Creole Petroleum Corporation, with reserves estimated at 4,200,000,000 barrels.

Gulf Oil Corporation is fifth in reserves, holding 3,925,000,000 barrels, including 1,100,000,000 in the U. S. and a conservatively estimated 3,925,000,000 barrels in Venezuela and the Middle East.

The Texas Company ranks sixth in the world and third among U. S. companies in reserves, holding an estimated 2,700,000,000 barrels after allowing for projected sale of a part of its equity in Saudi Arabian reserves.

Socony-Vacuum Oil Company, after purchase of 10 percent interest in Arabian American Oil Company, will hold 2,579,125,000 barrels of reserves and ranks seventh.

Standard Oil Company of California closely follows and is eighth in the world with reserves of 2,550,000,000 barrels after allowing for sale of a part of its interest in Saudia Arabia.

Humble ranks ninth in the world in amount of reserves owned and is the largest owner of reserves within the United States, being exclusively a do-

■ CONTINUED ON PAGE 47

Estimated Domestic and Foreign Crude Oil Reserves of Some U. S. Companies at Beginning of 1948

Reserve figures are official (from annual report or prospectus) only if marked with asterisk (*); otherwise estimated by WORLD OIL with aid of various sources, especially the pamphlet, "Petroleum," published in late 1948 by Merrill Lynch, Pierce, Fenner & Beane, New York.

(THOUSANDS OF BARRELS)

COMPANY	RESERVES			Net Domestic Production in 1947	Ratio of Domestic Reserves to Annual Production
	Domestic	Foreign	Total		
Amerada Pet. Corp.	400,000		400,000	20,067	19.9
Atlantic Ref. Co.	350,000		325,000	24,333	14.4
Barnsdall Oil Co.	210,000		210,000	10,312	20.4
Carter Oil Co. (100% owned by S. O. Co., N. J.)	†928,000		†928,000	†40,000	†23.2
Cities Service Co.	310,000		310,000	29,264	10.6
Continental Oil Co.	500,000		500,000	38,309	13.1
Creole Pet. Corp. (93% owned by S. O. Co., N. J.)		4,200,000	4,200,000		
Venezuela		4,200,000		§215,140	§
Gulf Oil Corp.	*1,100,000	2,825,000	3,925,000	78,882	13.9
Venezuela		575,000		§46,687	§
Kuwait (50% int. with Anglo-Iranian 50%)		2,250,000		§8,030	§
Humble O. & R. Co. (72% owned by S. O. Co., N. J.)	2,400,000		2,400,000	125,268	19.2
Lion Oil Co.	50,000		50,000	4,112	12.2
Mid-Continent Pet. Corp.	150,000		150,000	7,247	20.7
Ohio Oil Co.	580,000		580,000	33,050	17.5
Phillips Pet. Co.	897,000	3,000	900,000	34,741	25.8
Venezuela		3,000			
Plymouth Oil Co.	100,000		100,000	4,114	24.3
Pure Oil Co.	*500,000		*500,000	25,804	19.4
Richfield Oil Corp.	225,000		225,000	9,485	23.7
Seaboard Oil Co.	140,000		140,000	8,200	17.1
Shell Union Oil Corp.	800,000		800,000	71,356	11.2
Sinclair Oil Corp.	560,000	120,000	680,000	28,885	19.4
Venezuela		120,000			
Skelly Oil Co.	220,000		220,000	17,830	12.3
Socony-Vacuum Oil Co.	*1,141,000	1,438,125	2,579,125	60,909	18.7
Colombia-Venezuela		250,000			
Iraq (11.875% interest in Iraq Pet. Co.)		593,750			
Qatar (11.875% interest in Iraq Pet. Co.)		59,375			
Saudi Arabia (10% interest in Arabian-American Oil Co.)		360,000			
East Indies		175,000			
South Penn Oil Co.	*54,000		*54,000	3,881	13.9
Standard Oil Co. of Calif.	1,300,000	1,250,000	2,550,000	89,296	14.6
Sumatra-New Guinea		25,000			
Bahrein Is. (50% interest in Bahrein Pet. Co.)		145,000			
Saudi Arabia (30% interest in Arabian American Oil Co.)		1,080,000			
Standard Oil Co. (Indiana)	1,000,000		1,000,000	71,812	13.9
Standard Oil Co. (New Jersey)	2,656,000 (Net)	6,294,125	8,950,125	130,193	20.4
U. S. 72% of Humble's 2.4 billion)	1,728,000			90,193	
U. S. Carter Oil Co. etc.	†928,000			†40,000	
Venezuela (93% of Creole Pet.'s 4.2 billion)		3,906,000			
Colombia, Peru, Argentina		250,000			
Saudi Arabia (30% int. in Arabian American Oil Co.)		1,080,000			
Iraq (11.875% int. in Iraq Pet. Co)		593,750			
Qatar (11.875% int. in Iraq Pet. Co.)		59,375			
East Indies		200,000			
Canada		105,000			
Europe		100,000			
Standard Oil Co. (Ohio)	*120,000		*120,000	9,626	12.5
Sun Oil Co.	*680,000		*680,000	33,080	20.6
Sunray Oil Corp.	*153,000		*153,000	12,435	12.3
The Texas Co.	1,300,000	1,400,000	2,700,000	89,752	14.5
Colombia, Venezuela		150,000			
Sumatra, New Guinea		25,000			
Bahrein Island (50% int. in Bahrein Pet. Co.)		145,000			
Saudi Arabia (30% int. in Arabian American Pet. Co.)		1,080,000			
Texas Gulf Producing Co.	50,000		50,000	3,236	15.4
Texas Pacific Coal & Oil Co.	85,000		85,000	4,796	17.7
Tide Water Associated Oil Co. (Net)	*474,000		*474,000	32,296	14.7
Union Oil Co. of Calif. (Net).	*419,000		*419,000	27,743	15.1
Total Above Companies	‡17,196,000	⧗13,624,250	‡⧗30,795,250	‡1,050,122	16.4
(Percent of Total for all Companies)	69.5	33.9	47.4	56.6	
Total, Other Companies	7,545,660	26,571,100	34,141,760	805,985	9.4
(Percent of Total for all Companies)	30.5	66.1	52.6	43.4	
Total, All Companies	‡24,741,660	40,195,350	64,937,010	1,856,107	13.3

* Official figure, obtained from 1947 annual report or prospectus.
† Approximate; exact date lacking.
‡ Omits Standard (N.J.) interest in domestic reserves, held through subsidiaries, Humble and Carter, as Humble and Carter are here included.
⧗ Omits Standard (N.J.) interest in Venezuela reserves, held through subsidiary, Creole Pet. Corp., as Creole is here included.
‡ U. S. reserves of 24,741,660,000 barrels represent all liquid hydrocarbons and include 21,487,685,000 barrels crude oil and 3,253,975,000 barrels natural gas liquids.
§ Foreign production.

but keeps your engine free from sludge!

In some spinning and knitting processes, *static electricity* can really cause a lot of trouble. If the high-speed machines aren't properly "grounded" . . . if humidity control isn't just right . . . *static electricity* will cause the yarn to separate and fly apart and tangle up on the spools or in the looms.

Yet *static electricity* works *for you* inside your high-speed diesel and heavy-duty gasoline engines from the moment you start using Conoco HD Oil! For Conoco HD contains a special ingredient that charges solid particles in oil *electrostatically*, and forces them to stay apart . . .

. . . stops forming muck in the pan!
. . . stops gumming up in ring grooves!
. . . stops clogging up oil screens!
. . . stops lacquer baking on cylinder walls and pistons!

Extra benefits are Conoco HD's heat-resistance and ability to inhibit engine corrosion and oil oxidation! To get Conoco HD Oil *fast*, phone the nearest office of Continental Oil Company.

CONOCO HEAVY-DUTY OIL

CONOCO HD

Atomic Research

May Solve Important Oil Problems

By DR. THORFIN R. HOGNESS, University of Chicago

FEW people — least of all domestic oil producers—need be told about the enormous increase in oil consumption. Last year, this nation alone used more oil than the entire world did in any single year before the war. And yet, despite today's record-breaking output, the nation's overwhelming thirst for oil seems almost insatiable.

There is no mystery attached to this tremendous postwar demand for oil. Automobiles, trucks, and tractors now are using oil at an all-time high rate; railroads are pressing into service more and more oil-consuming diesel locomotives and 1½ million more homes are oil-heated than in prewar years. This is, of course, in addition to the vastly-increased industrial activity throughout the nation which is drawing heavily on our oil supply.

This demand is a normal, healthy sign. It means that our nation is progressing. But if this progress is to run its natural course—without obstruction —oil leaders must meet this production challenge.

Some answer to this problem and to many others, I believe, may be found in atomic research. Although no scientists can predict how much, or even how soon, the atom will influence our present standard of living, it can be safely stated that atomic science offers the greatest hope for the future—in industry, medicine, and agriculture.

Less than two years ago, most industrialists considered atomic energy the private problem of statesmen and scientists. Today, the practical considerations of atomic research are moving through industrial fields with chain-reaction speed and it is expected that the impact of the atom will cause important and far-reaching changes in industry—some in a relatively few years.

To understand how atomic science can be applied to the oil industry, it is necessary first to understand the atom itself.

The Atom

Each atom may be compared to a cathedral, in the center of which is a small, compact mass about the size of a pea. The nucleus of the atom is represented by the pea. Unlike the cathedral, however, practically all the weight of the atomic structure is concentrated in the nucleus. The nucleus itself—the pea in the cathedral—is made up of small particles known as protons and neutrons. The protons are positively charged and are united with neutrons bearing no electrical charge.

The shell of the atom—the wall of the cathedral—is composed of electrons. They are the lightest known particles and are almost weightless, the mass of the proton being about 1800 times greater than that of the electron.

Electrons are negatively charged. They circle about the nucleus in such rapid flight as to form a protective screen for it.

Each atom in each element in nature is perfectly balanced. For each positively-charged proton in the nucleus, there is always one endlessly circling negative electron in the outer shell or wall.

This is true of all matter. The lightest element, hydrogen, has one proton in its nucleus, balanced outside by one electron. Uranium, the heaviest natural element, has in its nucleus 92 protons, balanced outside, as the wall of the cathedral, by 92 electrons. There are three kinds of uranium atoms. All three have the same number of protons in their nuclei and the same number of outside electrons. These three kinds of uranium are known as isotopes; in other words there are three isotopes of uranium. The composition of the nuclei of these isotopes is as follows:

Uranium 238 — 92 protons and 146 neutrons

Uranium 235 — 92 protons and 143 neutrons

Uranium 234 — 92 protons and 142 neutrons

Naturally occurring uranium is made up of 99.3 percent U-238, 0.7 percent U-235, and a few hundredths of 1 percent of U-234. Uranium 235 is the only one of these isotopes which splits. This splitting process is known as fission.

When the nucleus of a uranium 235 atom is split, in an atomic pile, a tremendous amount of energy is released.

But the astounding difference between atomic energy and the energy with which we are familiar is the enormous amount which can be produced from a very small quantity of atomic fuel.

For example, less than 50 tons of atomic fuel, about a good-sized packing case full (uranium is a very heavy metal), would produce enough electricity to meet all the demands of the U. S. for one year, with a comfortable excess in reserve. A mass of atomic fuel, equal in size to a modern freight train, would produce enough energy to heat every building, illuminate every electric bulb, and operate every machine in the entire world for more than 20 years.

The astounding feature of atomic fuel

PROMISING GREAT benefits for industry, medicine, and agriculture, atomic science is expected to lead to important and far-reaching advances in techniques in virtually all phases of the petroleum industry, including exploration, production, refining, transportation, and storage.

Radioactive isotopes, by-product of the atomic bomb and popularly called tracers, exceed the microscope in their value to industry as well as science. Scientists already have discovered over 1000 possible industrial applications for radioisotopes, although this research still is in its infancy.

Radioisotopes are used by the petroleum industry for leak detection in high pressure gas pipe lines, for logging of geological strata, for determining age of methane.

Several oil companies are among 14 concerns participating in the University of Chicago atomic and metal research program. Other oil companies may keep abreast of atomic energy research by participating with universities in such work. Disadvantages of individual company research programs would include not only the large expense but also the critical shortage of trained personnel and materials required.

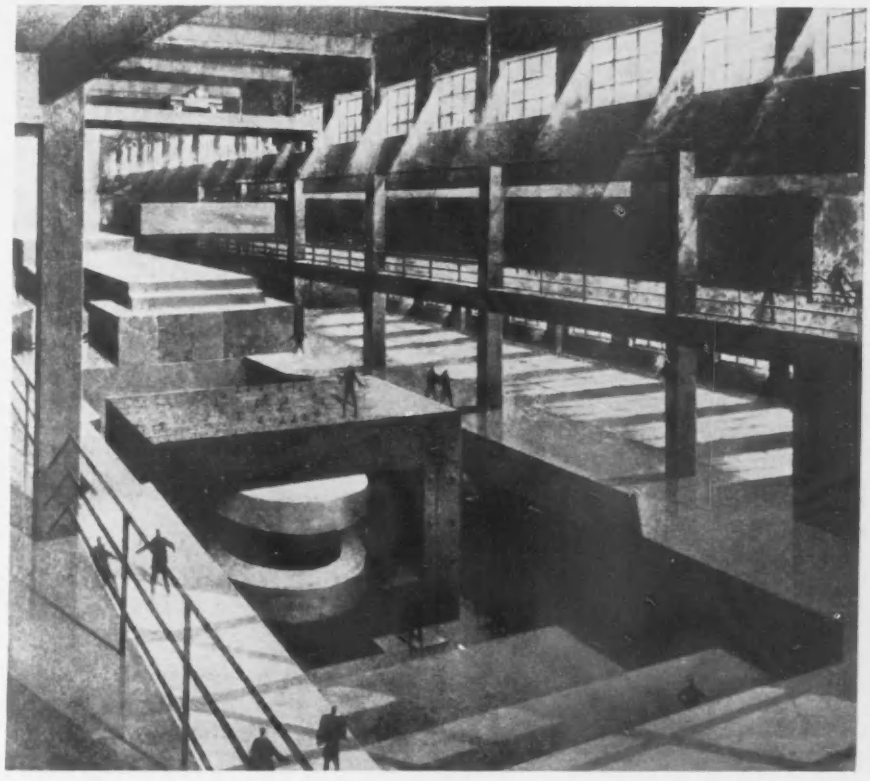
is that of reproducing itself. When uranium 235 undergoes fiission in an atomic pile to produce power it can at the same time make more fuel out of cheap materials than was consumed. It is as though we could sift more than one ton of coal out of the ash produced by a ton.

Although atomic power is certain to influence our industrial operations within a few years, it is the by-product of the atomic bomb—radioactive isotopes—which interests industry today.

These radioisotopes, popularly called tracers, are equal to and exceed the microscope in their value to science and industry. This year, for the first time, the Atomic Energy Commission has made radioisotopes available to industry in quantity and they are cataloged and stocked like other materials.

Radioisotopes are the same as stable isotopes except that their nuclei disintegrate with time. In disintegration, radioisotopes throw off high-energy rays (alpha, beta, or gamma), which can be detected by sensitive instruments, such as a Geiger counter. Carbon 14 is such an isotope. This is the basis on which the tracer technique is being developed.

Like uranium, carbon consists of several isotopes; the known isotopes are carbon 11, carbon 12, carbon 13, and carbon 14. Carbon 12 is the commonest of these.



Interior of accelerator building under construction at the University of Chicago. In the foreground are the core and winding of the new 2500-ton cyclotron.

The tracer technique is simply this: when a radioisotope is introduced into any process—an oil refinery, a blast furnace, the roots of a plant, or even the human body—scientists can trace its movements. Thus, the substance becomes "transparent" and it is as though the scientist were looking through a pane of glass.

Before radioisotopes were available in quantity, scientists had to conduct trial-and-error experiments and only knew the end results. Now with this fantastic new research tool, scientists are able, for the first time in history, to know what is taking place inside a changing substance.

Prewar Cost

Radioisotopes were known to scientists and manufactured in cyclotrons before the recent war. But they were so expensive that experiments were prohibitive.

A millicurie of carbon 14, for example, would take about three years to make and cost about $1 million if manufactured in a cyclotron. Today, an atomic pile will produce the same quantity overnight for less than $50.

In a comparatively short time, scientists have discovered more than 1000 possible industrial applications for radioisotopes and this research is still in its scientific infancy. This list of practical uses is, of course, entirely apart from the assistance they are giving for medical research—particularly cancer—and the study of plant and animal growth.

No one knows where or when the lightning will strike next. Atomic science is so new and so startling in its potentialities that its impact on any phase of activity is unpredictable—but certain.

At present, there are more than 100 different radioisotopes listed in the Atomic Energy Commission catalog. The list offers a wide variety in cost, radiation, and "half-life."

The "half-life" of a radioisotope, which ranges from less than a second to several million years, is the time it takes for an isotope to lose half of its radioactivity. For example, the half-life of silver 111 is 7½ days. This does not mean that at the end of 15 days silver 111 is "dead." It means that at the end of 7½ days silver 111 loses half of its radioactivity. Then, in another 7½ days, it will lose half of what is left. And so on.

Choosing the right radioisotope for a particular application obviously is important. For example, in leak detection in high-pressure pipe lines it is necessary to add a tiny amount of radioactive material to the gas running through the line. If there is a leak, instruments will

About the Author

DR. THORFIN R. HOGNESS is one of the key figures in the University of Chicago's $12 million peacetime atomic and metal research program, which comprises the Institute for Nuclear Studies, the Institute of Metals, and the Institute of Radiobiology and Biophysics. In addition to his responsibilities as a professor of chemistry, he is director of development for the Physical Sciences at the University of Chicago.

During the recent war, he served with the Office of Scientific Research and Development and was scientific liaison officer in London in 1942-43. He was director of the Maryland Research Laboratory for the OSS in 1943 and then returned to the University of Chicago to take over the directorship of the Chemistry Division of the Atom Bomb Project.

detect instantly the radiation in the escaping gas and sound an alarm.

For this particular use, a radioisotope is needed whose activity will continue long enough for the gas to go through the pipe. But if the radioactivity is too long, it will contaminate the walls, ceilings, floors, and machinery, thus making future leak-detection impossible.

Oil Industry Uses

The oil industry, among many others, already has found some uses for radioisotopes, but it is expected that many more will be discovered as atomic science progresses.

Radioactivity has been used for some time for logging of geological strata. Both gamma rays and neutrons are used for this purpose. Strata in various districts can be identified as common by not only the natural radioactive content by also by the ability to reflect gamma rays and by the interaction between neutrons and the rock adjacent to them. By this means, the porosity, the water content, and oil content can be estimated. The method has the advantage that the casing does not interfere with the logging process. In the past, radium was used as the source of these rays. Now radium can be replaced by materials made in the atomic pile at a relatively low cost. Radioactivity is also used to determine the efficiency of "squeeze cementing."

Such information guides the oil driller by telling him how much deeper he may expect to drill to strike in the same or adjacent fields.

Another important advance which may aid in determining the presence of oil has been developed by Dr. Willard F. Libby of the University of Chicago's Institute for Nuclear Studies. By studying the carbon 14 content, Dr. Libby can determine the age of methane, a gaseous hydrocarbon. If the methane is young—10,000 years or under—it indicates that the source of the methane is not entirely an oil or gas deposit. However, if the methane is found to be 20,000 years old or more, the chances are that it came from some subterranean deposit.

Theoretically, it is possible to use radioisotopes to trace the courses of subterranean oil pools. However, it should be explained that this technique, at present, is extremely complicated and too expensive to be practical. But it also should be explained that atomic science may solve this particular problem which is fundamental to the oil industry. At some future time, a method may be found to locate pools much more simply and economically than present techniques. Once again, it must be stated that it is not possible to predict when and where science will find the answer.

Many chemical processes including oil refining require catalysts, i.e., seemingly extraneous materials which selectively promote the chemical reactions in question. But little is known basically about the mechanism of catalytic action nor about the many steps involved before the final product emerges. Catalysts are found experimentally by the slow method of trial and error, the so-called "Edison method" of trying everything on the shelf.

When high octane gasoline is produced, molecules which have carbon atoms lined up in one row are changed into molecules in which carbon atoms have a branched formation like the trunk and branches of a tree. Catalysts promote these changes at relatively high temperatures. But very little is known about the exact nature of this reforming process. By using carbon 14 atoms, i.e., atoms that are tagged, it becomes possible to follow them around the various steps. When we have this information we should then be much better equipped to know more about catalysts.

Tracers can also be used very advantageously for analytical work in connection with catalysts. Suppose the job at hand is that of making a very desirable high octane gasoline from some given hydrocarbon. It that hydrocarbon contains carbon 14 atoms and is brought in contact with a likely catalyst, most likely a mixture of a lot of different kinds of molecules, a "schmierstoff," will be the first result. How much of the desired kind of molecules was produced? To determine that today with ordinary hydrocarbons is very difficult and tedious, but with tracers the job becomes relatively simple. We merely add some of the desired material to the "schmierstoff," diluting the radioactive molecules of the same kind, and then make the separation and determine the radioactivity. The trick here is that it is much easier to separate one component which is present in large amount than if it is present in small amount. Furthermore, it is not necessary to remove all of this desired component to make a quantitative analysis. By this procedure, much time can be saved.

Here is another example of how tracers are being used in the catalytic process for synthesizing oil. When carbon monoxide and hydrogen are mixed, nothing happens. In the presence of iron or cobalt, however, the two gases will combine to form a synthetic petroleum. The iron appears to be unaffected. But what happens to it in the process?

There is a theory that the carbon monoxide forms an iron carbide on the surface of the iron. Then the hydrogen reacts with the carbide to form oil, with the iron left behind to form new carbide. This can be checked by using radioactive carbon to form a carbide on the iron surface—before it is put in. If the theory is correct, the oil should be radioactive when it comes out.

The Problem of Combustion

Just as we know practically nothing about the details of the cracking and reformation process, so we also know practically nothing about what happens in the gasoline engine. Tracers open new avenues of approach to the study of explosions. By mixing a radioactive component into gasoline we can determine by measuring the radioactivity of the resulting gases, which component burns the quickest and which one gives us the trouble. Again, what kinds of lubricating oils burn the slowest can be determined by this same technique.

A device known as a "Gagetron" already is in use to measure, record and control the liquid level in oil-processing tanks. The technique is this: when a radioisotope is installed on the inside of an oil tank, it acts as a radio transmitter, sending out a continuous signal. Since oil absorbs more of the signals than air, a detector outside the tank will receive a weaker signal when the radioisotope is covered by oil than when it is not. Variation of the signal strength can be used to move a control valve and hold the liquid at or below the level of the radioisotope source.

Experiments now are being conducted to study the efficiency of lubrication. For example, if a journal is treated with radioactive material—and the lubrication is perfect—there will be no transfer of the radioactive material to the bearing. If the lubrication is imperfect, the remedy can be determined by the amount of radioactivity which has transferred to the bearing.

The presence of sulfur in oil has always been a problem to producers. Scientists now are substituting radioactive sulphur in experiments to determine the easiest way to get the sulphur out of the oil.

In the foreseeable future, it may be possible to make edible fats from petroleum. For this purpose we must have straight chain hydrocarbons, for branched chain fats are not digestible—another catalytic problem.

Radioisotopes may be used to study the mechanism of corrosion which could lead to better metals. Also, tracers can be put to work as corrosion detectors. For instance, with tracers, thickness measurements, taken from outside of tanks and pipes, would reveal the extent of corrosion without interfering with the process.

It has been suggested that an atomic bomb might be detonated at the bottom of a dry well and thus turn it into a

Christmas

Let Christmas be a bright and happy day; but let its brightness come from the radiance of the star of Bethlehem, and its happiness be found in Christ, the sinner's loving Saviour.

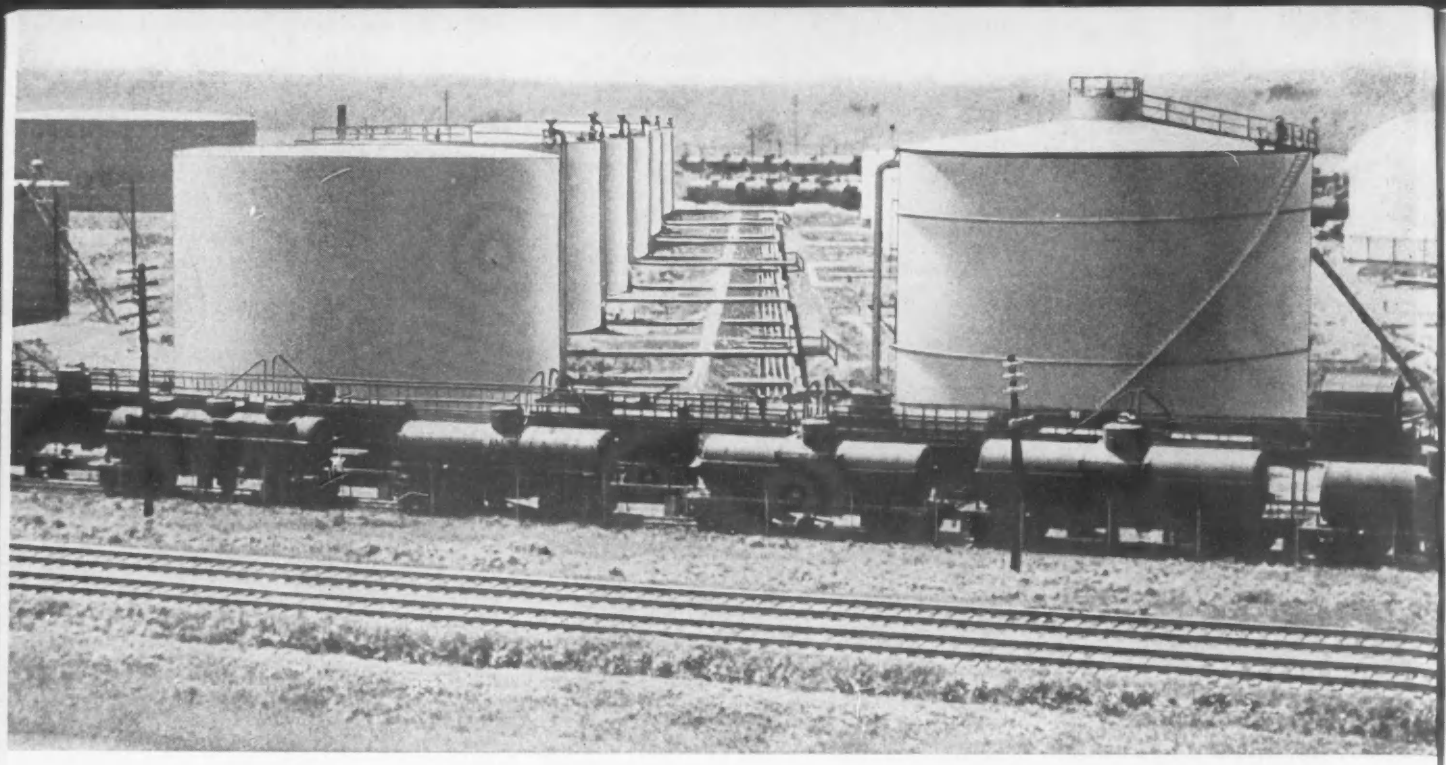
—*H. C. Dee*

GRAY

TOOL COMPANY

HOUSTON

Export Representative: GUY E. DANIELS, 30 Rockefeller Plaza, New York, N. Y.—
Rocky Mountain Representative: CARL MOULDEN, P. O. Box 1510, Casper, Wyo.



EVAPORATION THE ENEMY OF CONSERVATION

The Wiggins Dry Seal Gasholder shown above at the right, interconnected to six storage tanks is enabling a prominent oil company to turn vapor losses into profits. Today — more than ever before — this is both a patriotic and economic necessity.

A new booklet "Wiggins Vapor Balancing Systems" is now available. It describes and illustrates many exclusive Wiggins design and construction features of both the Wiggins Lifter Roof and the Wiggins Dry Seal Gasholder.

Charts of various types of evaporation losses, a graph and "Pay-Out Analysis" table should prove valuable to every executive and engineer responsible for the efficient storage of products subject to evaporation losses. Write for a personal copy today.

WIGGINS CONSERVATION STRUCTURES

- Hidek Floating Roofs
- Lodek Floating Roofs
- Balloon Roofs
- Breather Roofs
- Dry Seal Lifter Roofs
- Dry Seal Gasholders

WIGGINS VAPOR SEALS
GENERAL AMERICAN
TRADE MARK

GENERAL AMERICAN TRANSPORTATION CORPORATION

135 SOUTH LA SALLE STREET, CHICAGO 90, ILLINOIS

BRANCH OFFICES: New York • Washington, D. C. • Cleveland • Buffalo • Pittsburgh • St. Louis
New Orleans • Tulsa • Dallas • Houston • Seattle • Los Angeles • San Francisco

Sub-licensees

WESTERN STATES: Consolidated Steel Corp.—Western Pipe & Steel Co. of California, Los Angeles—San Francisco • CANADA: Toronto Iron Works, Ltd. Toronto
SOUTHERN STATES: Wyatt Metal and Boiler Works, Houston — Dallas, Texas • GREAT BRITAIN: Motherwell Bridge & Engineering Co., Ltd., Scotland
FRANCE: Etablissements Delattre & Frouard reunis, Paris

producer. Since oil often occurs near earth faults, a heavy blast might extend the fault or open it up so that the oil could be reached. The channels through which the oil flows might be enlarged and a large area drained through one well.

This is very probably impractical, for two principal reasons: First, the cost of building an atomic bomb is enormous, and secondly, the radioactivity released would make it impossible to take the oil out of the deposit for a very long time. However, it is possible that such an explosion, equivalent to perhaps 50,000 tons of nitroglycerine, would produce channeling a long distance away.

The commercial applications of the actual and potential benefits of atomic science to the oil industry are obvious. The problem to oil men, of course, is how to keep pace with the fast-changing atomic developments as they can be applied to their particular interests.

One alternative—and rather expensive—is for a company to establish its own atomic research program. This is a very difficult approach because of a critical shortage of trained personnel and material.

Another alternative — and comparatively economical — is for a company to participate with a university conducting atomic research.

Industrial Plan

At the University of Chicago, for example, of the 14 industrial members participating in the $12 million atomic and metal research program, four of them—Standard Oil Company of Indiana, Sun Oil Company, Shell Oil Company, and Standard Oil Development Company of New Jersey—are among the nation's leading oil concerns.

Other members who have joined in the program include: U. S. Steel Corporation, Westinghouse Electric Corporation, Celanese Corporation of America, Pittsburgh Plate Glass Company, Inland Steel Company, Bethlehem Steel Company, Aluminum Company of America, and the Beech-Nut Packing Company.

To become a participating member, industrial concerns have two choices: they may join all three institutes (nuclear studies, metals and radiobiology and biophysics) at $50,000 a year for five years, or they may join only one institute at $20,000 a year for five years.

Under the plan, industrial members have four specific advantages. It is almost inevitable that these advantages should pay off in the long run with both useable and profitable scientific knowledge. These advantages are as follows:

1. Methods or results which may be of particular importance to their own industry are available to members through personal conferences.

2. The University of Chicago does not intend to patent any development unless it would be of general interest to mankind. This means that industrial members have an advantage in time on any industrial applications which they may develop from contact with the university's atomic scientists and metallurgists.

3. Partnership with a university is the most direct avenue through which information concerning the basic structure of matter can now be obtained by American industry.

4. Members meet with atomic scientists and metallurgists in quarterly conferences conducted at the university to discuss current progress and techniques.

In launching the new $12 million research program, the University of Chicago has developed what is now known as "the scientific method of the Atomic Age."

During the war it was learned that the incredible complexity of atomic and metal research made it almost imperative that any comprehensive problem be attacked by a team of scientists. One man could not be expected to stay abreast of the tremendously advanced knowledge of physics, chemistry, mathematics, and metallurgy necessary to solve the problem.

This same principle also is true now—in peacetime—and the same teamwork, the same amount of energy, and the same amount of scientific knowledge must be expended if we are able to develop the atom as a tool as efficient in peace as the bomb was in wartime.

Members of the Board of Trustees of the University of Chicago were among the first to recognize that fact. Consequently, as far back as 1945 they took steps to guarantee that the same scientists who built the first atomic pile would remain together as a team.

Among the distinguished scientists who make up the University of Chicago's scientific team are three Nobel Prize winners, Drs. Enrico Fermi, James Franck, and Harold C. Urey; Drs. Harrison Brown, Samuel K. Allison, Willard F. Libby, Joseph Mayer, Arthur Dempster, Raymond E. Zirkle, Cyril S. Smith, Marcel Schein, and Leo Szilard.

It is axiomatic that the only predictable thing about scientific achievement is the unpredictability of its final results. But a few things are certain: atomic science has opened a whole new era of opportunity in many fields. The new opportunities offer rich rewards to those who exploit them with courage, imagination, intelligence, and well-directed research.

World Reserves

■ CONTINUED FROM PAGE 40

mestic concern. Humble's reserves are estimated at 2,400,000,000 barrels. About 72 percent of Humble's stock is owned by Jersey Standard.

Compagnie Francaise and Petroleos Mexicanos are tenth and 11th in reserves, each holding over 1 billion barrels.

Twelfth in the world and the only other company with as much as 1 billion barrels of reserves is Standard Oil Company of Indiana. Phillips Petroleum Company is not far behind, however, with 900 million barrels, while Shell Union Oil Corporation holds about 800 million barrels.

Other U. S. companies with reserves at or above ½ billion barrels include Continental Oil Company, Ohio Oil Company, Pure Oil Company, Sinclair Oil Corporation, and Sun Oil Company. Companies with reserves of 400 to 500 million barrels include Amerada Petroleum Corporation, Tide Water Associated Oil Company, and Union Oil Company, of California. Reserves of 300 to 400 million barrels each are owned by Atlantic Refining Company and Cities Service Company, and from 200 to 300 million barrels each are held by Barnsdall Oil Company, Skelly Oil Company, and Richfield Oil Corporation. Reserves between 100 and 200 million barrels each are credited to Mid-Continent Petroleum Corporation, Plymouth Oil Company, Seaboard Oil Company, Standard Oil Company of Ohio, and Sunray Oil Corporation. Companies holding 50 to 100 million barrels each include South Penn Oil Company, Texas Pacific Coal & Oil Company, Texas Gulf Producing Company, and Lion Oil Company.

Of the total U. S. domestic reserves of 24,741,660,000 barrels, 69.5 percent is held by about 30 companies and 30.5 percent is held by many smaller producers, indicating an exceptionally decentralized and competitive industry.

For the U. S. industry as a whole reserves at the beginning of 1948 were equivalent to 13.3 times the nation's crude production in the year 1947. The 30 larger companies held reserves 16.4 times annual production, having owned relatively more flush production and less settled production than smaller concerns whose reserves were 9.4 times annual production. Individual companies are differently situated as regards reserves some of the larger concerns having reserves more than 20 times their annual production, while others have reserves ranging down to 10 times annual production.

Liquid Fuels from Oil Shale

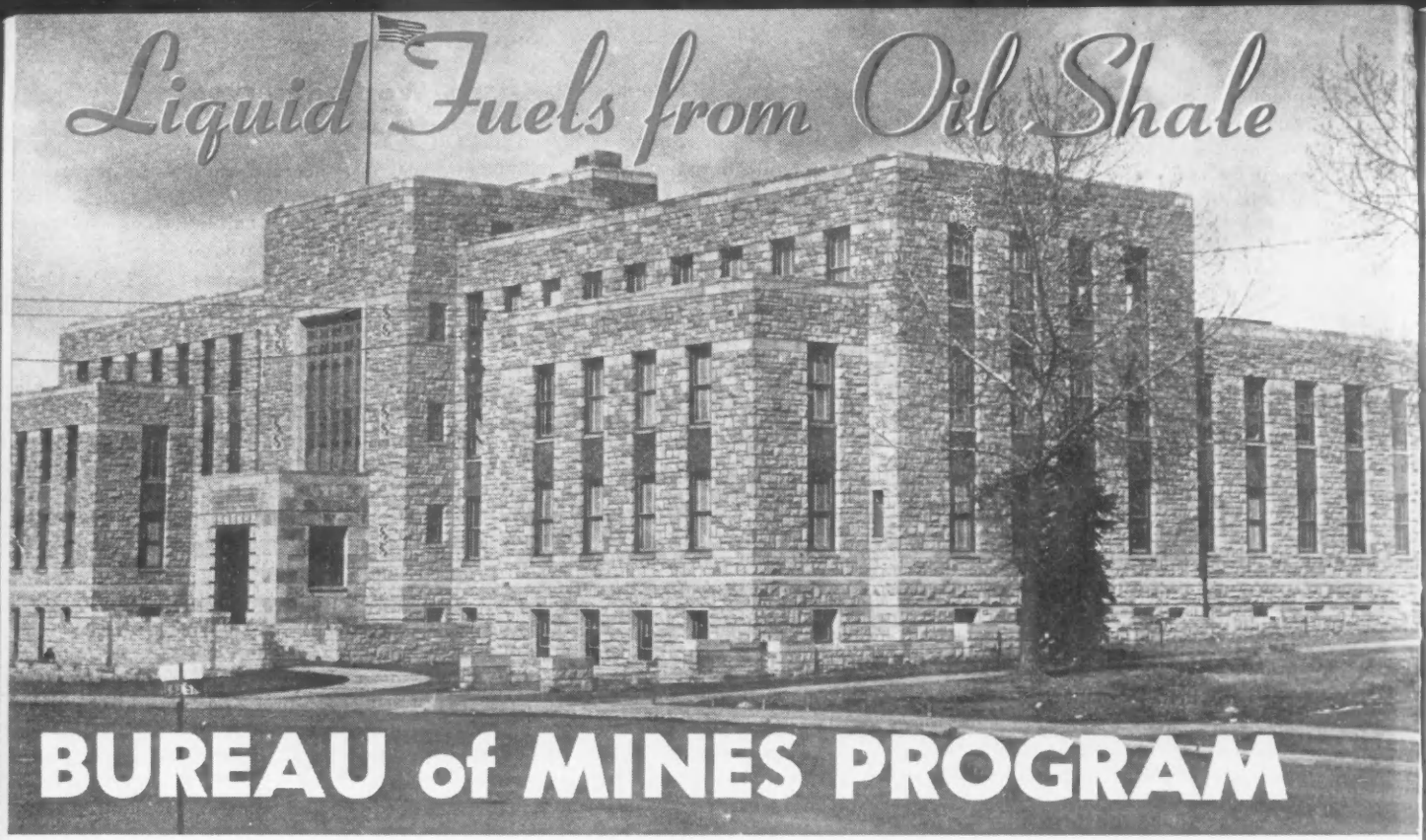


FIGURE 1. Petroleum and Oil-Shale Experiment Station of the U. S. Bureau of Mines at Laramie, Wyoming. Building is adjacent to the University of Wyoming campus.

By A. J. KRAEMER

Assistant Chief, Oil-Shale Research and Demonstration Plant
Office of Synthetic Liquid Fuels, Bureau of Mines

THERE were oil-shale and coal-oil plants in the U. S. when the first well was drilled for oil in Pennsylvania in 1859.[1,2] These soon succumbed to the competition of petroleum, and there was little activity in this country until World War I. The Bureau of Mines began its study of oil shale in a small way before the U. S. entered World War I and resumed the study in 1919. This phase of the Bureau's oil-shale work terminated with the closing of the Bureau of Mines Oil Shale Experimental Plant near Rifle, Colo., on June 30, 1929. Closing of this plant was motivated mainly by the discovery of large oil fields in California, Oklahoma, and Texas, and the likelihood of an abundance of petroleum rather than a scarcity.

Five or six years ago, when the U. S. again seemed likely to face a shortage of petroleum, interest in oil shale as a source of liquid fuels was revived and plans were made for the Bureau of Mines to conduct comprehensive studies of the technical and economic problems involved in oil-shale utilization, and to develop methods and equipment suited to conditions in this country. In 1944 the Congress authorized the Secretary of the Interior, acting through the Bureau of Mines, to construct and operate demonstration plants to produce synthetic liquid fuels from coal, oil shales, agricultural and forestry products, and other substances. Pursuant to this act, known as Public Law 290, 78th Congress, Second Session, and subsequent congressional appropriations, the bureau is constructing and operating plants to demonstate processes for making gasoline and other liquid fuels from various kinds of coal and from oil shales of the U. S., and is conducting research to develop and to improve the equipment and methods for these purposes.

EXTRACTING OIL from a rock called oil shale and refining the oil into gasoline and other products usually obtained from petroleum is an old art that has been practiced in foreign countries for more than a century. It has not been employed in the U. S. on a large scale because this country has had plentiful supplies of petroleum. However, at times in the past when it has seemed likely that we might be running short of petroleum, attempts have been made to establish an oil-shale industry here. This article is published by permission of the Director, Bureau of Mines, Department of Interior, Washington, D. C.

The oil-shale work of the Bureau of Mines is divided between the Oil-Shale Mining Branch, E. D. Gardner, chief, with headquarters in Denver, and the Oil-Shale Research and Demonstration Plant Branch, of which R. A. Cattell, chief of the Bureau's Petroleum and Natural Gas Division, is acting chief. The two oil-shale branches are part of the Office of Synthetic Liquid Fuels, of which W. C. Schroeder is chief.

Present field operations of the Bureau of Mines in connection with utilization of oil shale are being conducted at Laramie, Wyo., and Rifle, Colo. The Oil-Shale Research and Development Laboratories are a part of the Petroleum and Oil-Shale Experimental Station, Laramie, Wyo. (Figure 1), and are

under the general direction of H. P. Rue, supervising engineer of the station. The research and development work is under the immediate supervision of H. M. Thorne, engineer-in-charge of the oil-shale laboratories. The laboratories have up-to-date equipment for research in the chemical, physical, and engineering phases of oil-shale technology. The function of the laboratory is to obtain basic physical, chemical, and thermodynamic information needed for understanding the problems of oil-shale utilization, and to develop processes and apparatus to the point that they are ready for large-scale trial at the demonstration plant at Rifle.

One of the purposes of Public Law 290 is "to furnish industry the necessary cost and engineering data for the development of a synthetic liquid-fuel industry." The bureau's demonstration plant near Rifle, comprises two oil-shale mines and various retorts for extracting oil from shale, and equipment for refining shale oil is under construction. There are also the usual auxiliary facilities and utilities, such as office and shop buildings, water, electricity, and telephones, and a housing area for employes and their families. Boyd Guthrie is supervising engineer of the plant.

At the Rifle plant processes for oil-shale mining, transportation, crushing, oil extraction, and shale-oil refining are conducted on a scale that will demonstate how these operations would be carried out in a commercial-scale plant. Figure 2 gives an idea of the conditions under which oil-shale operations would be conducted commercially in Colorado. The mine is at an altitude of 8200 feet above sea level and is 2500 feet above the elevation of the retorting plant and residence area. Water for the plant and residences comes from the Colorado River at an elevation of 5200 feet. At the present location the shale is being hauled from the mine to the crushers at the retorting plant over the 5½-mile winding road. In a larger permanent plant, which might be placed just below the mine, the shale might be transported by one of several different methods depending upon topography.

Until recently the impression seems to have prevailed in the petroleum industry that manufacture of a substantial proportion of the liquid-fuel supply of this country from oil shale would not be practical, because costs would be high in comparison with those for petroleum production, transportation, and refining. The bureau's basic idea has been that the problem of making oil from shale must be solved by low cost, large-scale handling of materials. Although the bureau's program is still in an early stage. it has shown that requirements and costs need not be unduly high.

Definition of Oil Shale

A rather large variety of rocklike materials occurring throughout the world have certain common characteristics and other characteristics that differentiate them. They have the common characteristic of containing a relatively large proportion of carbonaceous matter, called kerogen, which is almost completely soluble in organic solvents. These rocks are known by various names, including oil shale, torbanite, and kukersite. The definition of oil shale adopted by the American Society for Testing Materials[3] is a slightly modified form of the definition proposed by Gavin:[4]

> Oil Shale—A compact rock of sedimentary origin, with an ash content of more than 33 percent and containing organic matter that yields oil when destructively distilled but not appreciably when extracted with the ordinary solvents for petroleum.

Oil-soaked sands, such as those of Utah and California, and Alberta, Canada, are excluded from this definition because the organic matter they contain can be extracted by organic solvents; in fact, the oil can be separated from the mineral matter by means of

FIGURE 2. Aerial view of the Bureau of Mines Oil-shale Demonstration Plant on Naval Oil Shale Reserves near Rifle, Colo. Housing area, center, at the end of straight section of road; plant, right center, with curving road approach; mine, upper left, at the terminus of zig-zag road which ascends about 3000 feet to the oil-shale cliffs.

hot water, with or without the addition of certain chemicals.

Oil shales of the U. S. range in oil yield from less than five gallons to more than 80 gallons to the ton, and Australian torbanite yields as much as 145 U. S. gallons to the short ton.

Oil-Shale Reserves

Reserves of oil shale in the U. S. are estimated by Dean E. Winchester of the Federal Geological Survey[5] as having recoverable oil to the extent of 92 billion barrels. Of this quantity, 75 billion barrels was ascribed to the Green River formation of Eocene age in Colorado, Utah, and Wyoming, and nearly 17 billion barrels to the Devonian shales of Kentucky and Indiana. Winchester's estimate included shale as lean as 15 gallons a ton in the western area and 10 gallons a ton in Kentucky and Indiana, which may be contrary to what can be done under commercial conditions.

More intensive recent study of the oil-shale deposits in Colorado by the bureau and the Geological survey[6] indicates that the Colorado shales have a much greater potential yield of oil than Winchester estimated. More detailed surveys elsewhere may indicate like increases.

Near Rifle, Colo., is a large escarpment or cliff, into which the Bureau's two oil-shale mines have been developed. Figure 3 is a typical graphic log of the assay value of the shale beds on Naval Oil Shale Reserves No. 1 and No. 3 near Rifle. The vertical axis of the log is in feet, and the horizontal axis is in gallons of oil per ton of shale. The total thickness is 700 feet, and the log shows a section about 78 feet thick (from 400 to 478 feet) that has an average assay value of 30 gallons a ton. This 30-gallon bed of shale extends for many miles in western Colorado and has a potential oil yield of 70 million barrels a square mile, allowing for pillars that would be left in mining the deposit by underground methods. Naval Oil Shale Reserves No. 1 and No. 3 alone, in which the Rifle mines were developed, have a recoverable reserve of about 5 billion barrels, and there is much good oil-shale land in private ownership in this area.

Four square miles of the 70-odd feet of 30-gallon shale, yielding 70 million barrels of oil to the square mile, would supply a retorting plant and refinery for nearly 20 years, at the rate of 40,000 barrels of product a day.

The Bureau has two oil-shale mines in connection with the Rifle plant.[7] One has been developed so that any of eight beds of shale exposed in the seam 70 feet thick can be mined and delivered to the retorting plant. Thus the performance of the retorts can be tested on each grade of shale. This is known as the "selective" mine, and is laid out to supply the plant with selectively mined shale—of any richness from 10 to 60 gallons of oil to the ton—that is needed at the retorting plant for the test program. The second mine is being operated to develop methods and to select procedures for mining the full 70-foot bed of oil shale without segregation that can be applied on a commercial basis at the lowest practicable cost. In effect, this mine is an underground quarry operating on 70 feet of oil shale.

Oil shale is mined much as any hard, tough rock would be. Horizontal passageways are driven into the face of the oil-shale cliffs by drilling a series of shot holes according to a predetermined pattern. The holes are loaded with blasting powder and fired. The resultant broken shale is removed, and the process is repeated. The crux of this basically simple, ancient operation is to do the work safely at the lowest practicable cost, because oil shale has a comparatively low value per ton. One of the most effective means of reducing costs per ton is to conduct the operations on a large scale, of the order of thousands of tons a day. Using large scale time and labor-saving equipment and the most efficient practices developed to date, it is estimated that the shale can be mined commercially at the rate of 15,000 tons a day in two shifts, at a cost (in present money values) of 59 cents a ton. A goal of the Oil-Shale Mining Branch is to reduce this cost to 50 cents a ton.

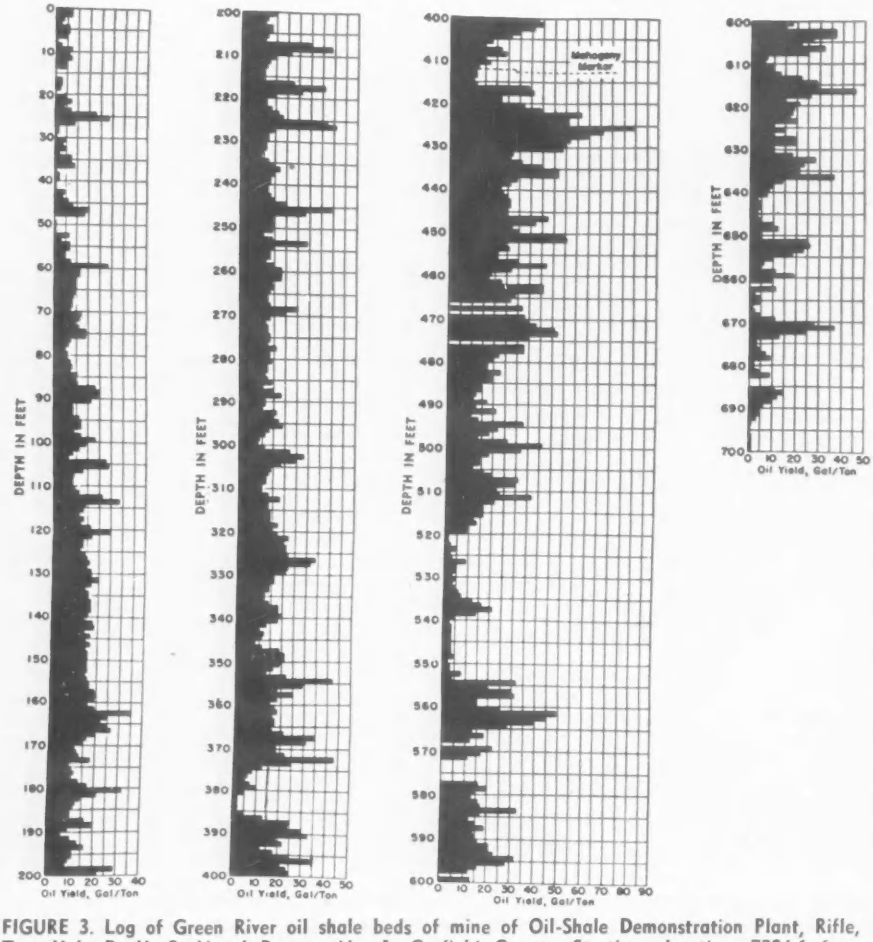


FIGURE 3. Log of Green River oil shale beds of mine of Oil-Shale Demonstration Plant, Rifle, Test Hole D, U. S. Naval Reserve No. 1, Garfield County. Starting elevation, 7804.6 feet.

Crushing

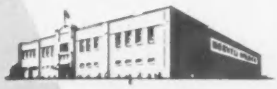
After the shale has been mined it must be crushed. Usually two or more stages of crushing are employed as a matter of over-all economy. It is not known definitely at present what type or combination of types of crushers will be most satisfactory or efficient for heavy-duty crushing. The particle size to which oil shale must be crushed depends upon the retorting method and ranges from ¼-inch and smaller to three inches or larger. Usually when large-size pieces such as three-inch are charged, the fine shale produced in the mining, transportation, and crushing operations is screened out and discharded or charged to a retort that will function on small sizes of shale.

The cost of crushing oil shale ranges upward from approximately 15 cents a ton, depending upon the quantity to be

SHREVEPORT

HOUSTON

FORT WORTH



BEAUMONT

LAKE CHARLES

CONROE

ODESSA

CORPUS CHRISTI

HOW THESE WAREHOUSES *help increase* YOUR PROFITS

you can actually increase your profits by taking full advantage of your nearest Norvell-Wilder Warehouse

Here are some of the ways leading operators have found that Norvell-Wilder can save you time and money:

- Norvell-Wilder's complete stocks practically eliminate the need for "company inventories"— thus saving money that can be used to increase profits.

- Norvell-Wilder's practice of locating scarce equipment before you need it saves you valuable time.

- Gathering facts on new equipment and how it works, and passing this information on to you, is another time-and-money-saving service offered you by Norvell-Wilder.

NORVELL-WILDER SUPPLY COMPANY

For dependable service call your **NORVELL-WILDER MAN**

GENERAL OFFICES AT BEAUMONT

FIGURE 4. Aerial view of Bureau Demonstration Plant at Rifle. Administration building, right; other buildings, front to rear: gatehouse, warehouse, shops and garage, pilot plant, boiler house, and retorting area. Future site of refinery unit is at far right.

crushed, the maximum sizes of pieces charged to the primary crusher, the particle size of the final crushed shale, and other factors.

Retorting

The equipment developed for heating crushed shale to form shale-oil vapors are known collectively as oil-shale retorts. Many types and varieties of retorts have been developed during oil shale's 100-year history. Dr. Simon Klosky, research analyst of the Oil-Shale Research and Demonstration Plant Branch, has compiled indexes of patents on oil shale and shale oil and the patents on retorting devices number well into the hundreds.[8]

Most of the retorts that have been technically successful on a large scale throughout the world are described and pictured in the Proceedings of a Conference on Oil Shale and Cannel Coal.[9]

Some retorts are vertical in structure, some are horizontal, and still others are inclined slightly from the horizontal. Some vertical retorts are continuous in operation and depend upon the force of gravity to feed the shale downward from the charging hopper to the spent shale receiver. The Scottish Pumpherston report, probably the best known of this type, employs gravity feed. Other vertical continuous retorts use mechanical devices to impart motion to the shale to assist it through the retorting zone. Some of these are variations of the Herreshoff ore roaster.

Horizontal retorts are mainly of two types. One type consists of adaptations of the rotary cement kiln, and the other embodies the tunnel-oven principle. The Davidson rotary retort is an example of the cement-kiln type. It is in use in South Africa and probably in Estonia.[9, 10] Tunnel-oven retorts are being used in Sweden and probably in Estonia.[9, 10] These consist essentially of a series of horizontal chambers, called tunnel ovens, in which the shale is heated while being drawn through the oven in small rail cars. The ovens are heated by circulating gases, and the volatile products are drawn off and cooled in condensers.

The Salermo retort,[10] used in South Africa, is a different type of horizontal retort. The heating section consists of 36 parallel semicircular troughs, 16 inches in diameter, set over a firebox or combustion chamber and covered by a hood with off-take conduits to collect and draw off the oil vapors and fixed gases. Shale is fed into the trough at one side of the furnace and scooped successively into the adjoining troughs by scrapers and discharged as spent shale from the thirty-sixth trough. The scrapers are rotated by a longitudinal shaft driven by bevel gears from a line shaft outside the walls of the retort.

Retorts at Rifle Plant

The N-T-U retort, which is one of those that the bureau has built at Rifle, is a batch or intermittent vertical downdraft retort in which the shale does not move from the time it is charged until the spent shale is discharged at the end of a run. The shale is heated to the retorting temperature by heat exchange with circulating gases, which in turn are heated within the retort by combustion of the fixed carbon on the spent shale.[11]

A pilot-plant unit, known as the Royster oil-shale retort, formerly designated by the bureau as the "Jodavis" retort, was borrowed from the Coal Carbonizing Section of the Central Experiment Station of the bureau at Pittsburgh and installed at Rifle to obtain thermodynamic and engineering information that could be used in designing continuous retorting processes employing hot circulating gases as the medium of heat transfer to the shale charge. In this retort the circulating gases are heated in two recuperative pebble stoves which alternately heat the retorting gases and are heated by combustion of fuel gas or fixed carbon of oil-spent shale. The unit is of batch type, with a capacity of 1500 pounds of shale and an operating cycle of one and one-half to four hours. Preliminary results of experimen-

National IDEAL
POWER SLUSH PUMPS

WEAR-PROTECTED*
for long life and low-cost service

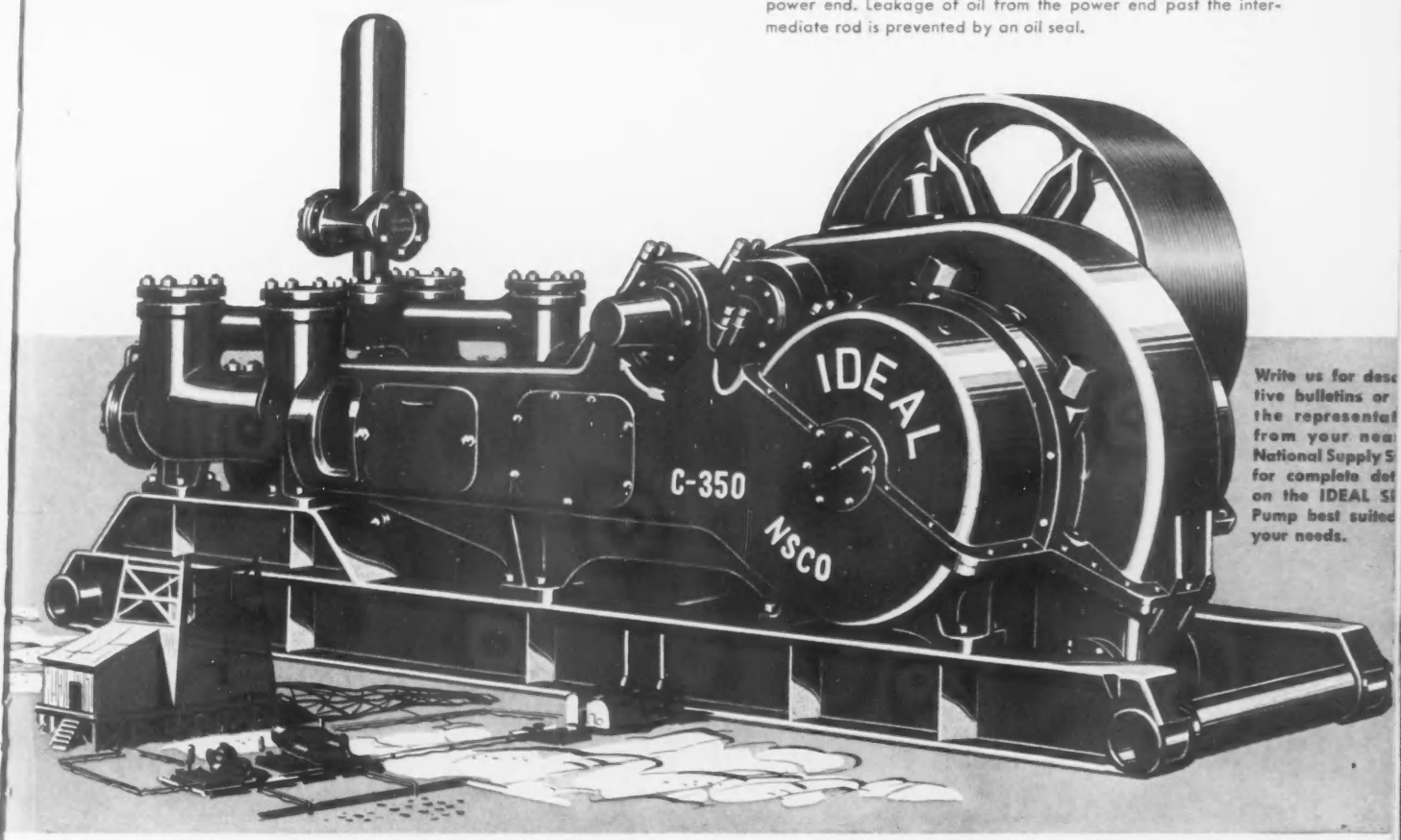
Because National IDEAL Power Slush Pumps are carefully protected at all wear points, they perform dependably and economically on tour after tour . . . delivering thousands of hours of heavy-duty service with minimum maintenance attention.

***Protected through Positive Lubrication**

Oil picked up by the main gear, which dips in the sump, is cascaded over the crossheads to provide lubrication for the crosshead bearings and guides, and is then returned to the sump. The crank and pinion shaft bearings are grease packed through connections easily accessible from outside the gear case to prevent infiltration of crankcase oil.

***Patented Protection from Contamination**

To prevent contamination of the crankcase oil, an intermediate wall is provided between the fluid end stuffing box and the power end oil seal. Only the fluid carried on the rod itself can get past this wall. A large baffle on the water piston rod lock nut prevents further travel of this fluid. Drilling fluid from a leaky stuffing box cannot be splashed on the intermediate rod and carried into the power end. Leakage of oil from the power end past the intermediate rod is prevented by an oil seal.



Write us for desc tive bulletins or the representat from your nea National Supply S for complete det on the IDEAL SI Pump best suited your needs.

THE NATIONAL SUPPLY COMPANY

GENERAL SALES OFFICE: TOLEDO, OHIO

DIVISION OFFICES: CASPER; FT. WORTH; PITTSBURGH; TULSA; TORRANCE.
EXPORT: NATIONAL SUPPLY EXPORT CORPORATION, 30 ROCKEFELLER PLAZA, NEW YORK, N. Y., U. S. A.; RIVER PLATE HOUSE, 12 SOUTH PLACE, LONDON E. C. 2.

THE NATIONAL SUPPLY COMPANY — NSCO

NATIONAL BLUE PRODUCTS

★ THE INDUSTRY'S MOST COMPLETE LINE OF OIL FIELD EQUIPMENT ★

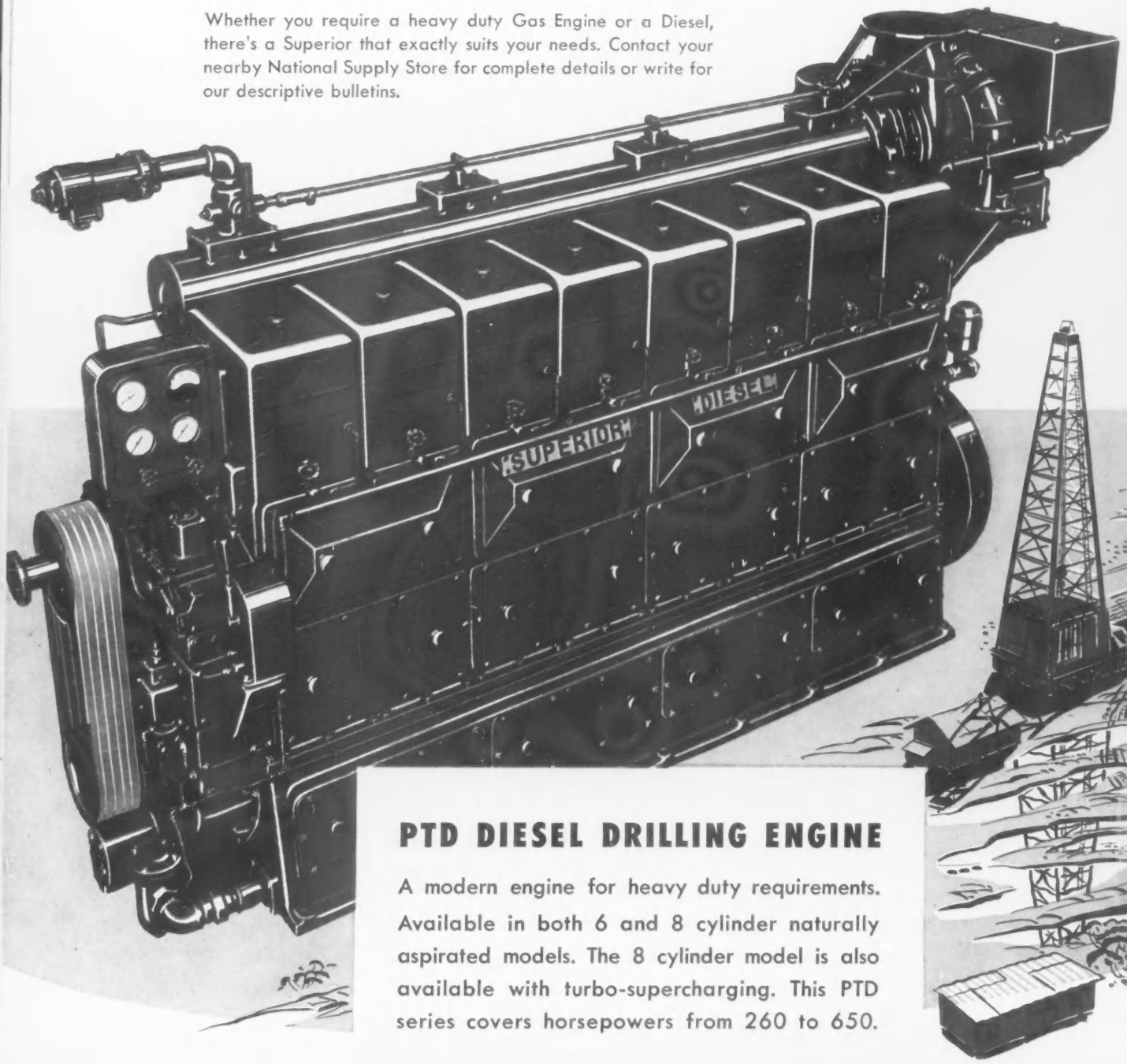
MAKE MORE ROUND TRIPS

...WITH THESE *Superior*

To drive big pumps . . . to pull long drill strings . . . and to get them back faster for more footage, select Superior. Add to this the economy and reliability of these two great engines and you'll easily understand why they're popular in oil fields everywhere.

Superior Engines respond to sudden load changes. Their dependability on the long steady drilling loads is never in doubt. Their ruggedness keeps them on the job . . . for many jobs, and that means better profit plus lower cost operation and maintenance.

Whether you require a heavy duty Gas Engine or a Diesel, there's a Superior that exactly suits your needs. Contact your nearby National Supply Store for complete details or write for our descriptive bulletins.



PTD DIESEL DRILLING ENGINE

A modern engine for heavy duty requirements. Available in both 6 and 8 cylinder naturally aspirated models. The 8 cylinder model is also available with turbo-supercharging. This PTD series covers horsepowers from 260 to 650.

FOR DRILLING ★ *THE INDUSTRY'S MOST COMPLETE*

..FASTER..

DRILLING ENGINES

6G-510 GAS DRILLING ENGINE

A strong, tough 300 h.p. distinctively designed engine that efficiently and economically fulfills the requirements of oil field service. Bulletin No. 315 contains complete engineering data and construction details.

SUPERIOR ENGINE DIVISION OF

THE NATIONAL SUPPLY COMPANY

PLANT AND GENERAL SALES OFFICE: SPRINGFIELD, OHIO

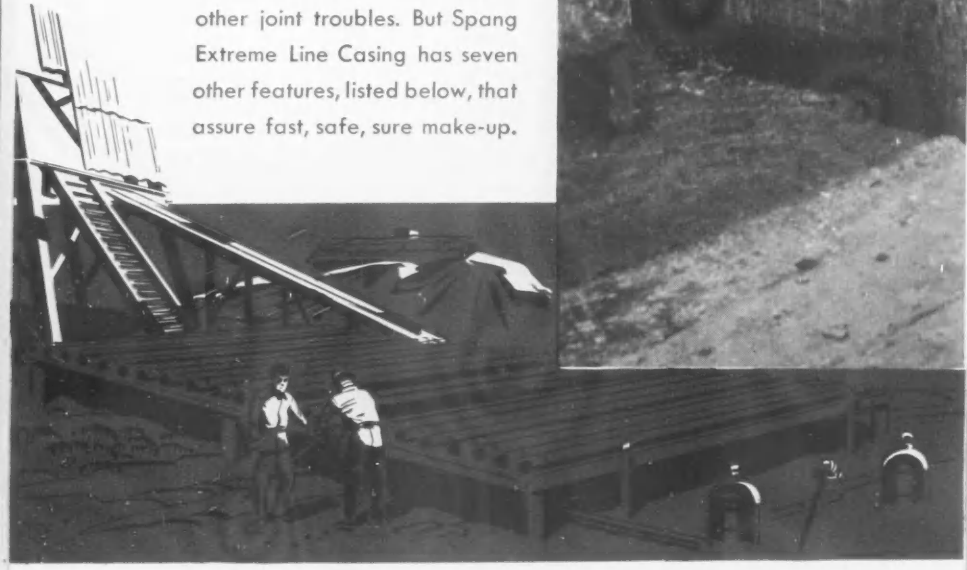
LINE OF OIL FIELD EQUIPMENT ★ FOR PRODUCTION

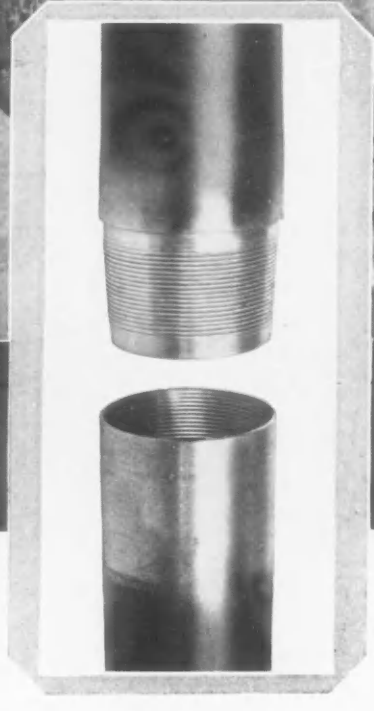
SPANG
EXTREME LINE CASING
...socks trouble where it lives!

Ordinary casing, joined by a coupling, has two threaded connections at every joint—two chances for trouble to strike.

But Spang Extreme Line Casing is different. On this casing, no couplings are used. Instead, one end of the pipe is upset for a female thread and the other for a male thread. Thus, the number of threaded connections on a string are cut in half—reducing by 50% the chances for trouble.

This one feature alone has played a major role in reducing leakage and other joint troubles. But Spang Extreme Line Casing has seven other features, listed below, that assure fast, safe, sure make-up.





ONLY SPANG EXTREME LINE CASING has all of these 8 advantages

1. High Joint Strength
2. Positive Resistance to Leakage
3. Minimum Outside Diameter at Joint
4. Maximum Speed in Running
5. Stream-lined Exterior Contour
6. High Resistance to Damage
7. Internal Flush Joint
8. 50% less Threaded Connections than A.P.I. Casing

SPANG-CHALFANT

DIVISION OF THE NATIONAL SUPPLY COMPANY
GENERAL SALES OFFICE: PITTSBURGH, PA.

DISTRICT SALES OFFICES: ATLANTA; BOSTON; CHICAGO; DENVER; DETROIT; HOUSTON; LOS ANGELES; NEW YORK; PHILADELPHIA; PITTSBURGH; ST. LOUIS; SAN FRANCISCO; TULSA

★ THE INDUSTRY'S MOST COMPLETE LINE OF OIL FIELD EQUIPMENT ★

FIGURE 5. Mine yard at the underground quarry near Rifle, Colo. Buildings house offices, miners' change room, first aid and supply storage facilities. Just below parked bus a diesel-powered truck may be seen rounding a turn. It carries 15 tons of oil shale to the demonstration plant.

tal runs have been encouraging and the data that were developed were used in the design of a continuous gas-flow retort," which is now being built at Rifle and is expected to be in operation this year. The gas-flow retort is designed for flexibility of operating conditions, and preliminary calculations indicate that enough heat will be available, either from combustion of the product gases or the fixed carbon on the spent shale, to furnish the heat needed to operate the retort.

Under a cooperative agreement between the bureau and the Union Oil Company of California, Los Angeles, a continuous retorting unit developed by the company is to be shipped to Rifle and operated to obtain additional engineering and thermodynamic data from which direct comparison can be made with other units being studied.

The Union Oil retort is a continuous, vertical, down-draft unit in which the required heat is obtained in much the same manner as with the N-T-U retort, by burning the fixed carbon from the oil-spent shale at the top of the retort. Raw shale is fed into the bottom of the retort, and the shale ash is discharged at the top, thus providing countercurrent flow of shale and combustion gases. Oil is evolved from the incoming shale by heat exchange with downward-flowing combustion gases.

The "fluidized-solids" technique, which has been developed on a large scale for catalytic cracking of petroleum, has been applied by Standard Oil Development Company to oil-shale retorting." Results of small-scale tests have been encouraging, and the bureau is cooperating with the company in testing the process on a larger scale. The company is converting a 100-barrel-a-day, catalytic-cracking pilot plant at its Baton Rouge, La., refinery for processing oil shale. The bureau will supply the shale and witness the tests.

In contrast with other types of retorts in which heat is transferred to the shale by exchange with heated gases, the Standard Oil Development process applies the principle of solid-to-solid heat transfer. Crushed shale is fed continuously to the retorting vessel (corresponding to the reactor of a catalytic cracking plant), where it is mixed with hot spent shale that has been transferred from the spent-shale burner, which corresponds to the catalyst regenerator of a catalytic cracking plant. In the spent-shale burner, part of the fixed carbon of the spent shale is burned off with air to heat the shale ash above retorting temperature. In this system the products of retorting are divided into three streams; (1) oil vapors and fuel gases from the retorting vessel, (2) flue gases from the spent shale burner, and (3) shale ash from the spent shale burner. Each of these streams contains available heat that may be used to generate steam and power needed in the process.

Thermal Solution Method

At the Oil Shale Research and Development Laboratory, Laramie, Wyo., a continuous retorting process utilizing a liquid heating medium is being studied. This is known as the "thermal solution" process, and a continuous bench-scale unit is in operation. The raw shale, together with a suitable solvent such as a "gas-oil" fraction of shale oil, is heated to 750° to 850° F. At these temperatures the solvent aids decomposition of the organic matter and a separation of shale oil is effected thereby. The process has the advantage of high yields and high rates of heat transfer, and if the results of the work now under way at Laramie appear favorable, a pilot plant will be built at Rifle.

Shale-Oil Refining

It was realized from the inception of the bureau's oil-shale program that shale-oil refining would be difficult, and the problem has been attacked from two viewpoints, the short-term view and the long-term view, or as simple refining and complete refining. Objective of the short-term project is to determine the minimum amount of, or the least costly, refining that will convert shale oil into boiler fuel, domestic heating oil, and diesel fuel oil. The U. S. demand for about 3 million barrels of these fuels daily is being met from petroleum, and it seems that in the present state of knowledge it may be easier to make

gasoline and other highly refined products from petroleum fuels that may be replaced by fuels made from shale oil than to attempt to make highly refined products from shale oil.

Complete refining of shale oil as studied at Laramie, has been called the "long-term view" but may not be as long as has been anticipated. All types of methods for changing the chemical structure of hydrocarbons and similar compounds are being applied to shale oil with encouraging results. Mild hydrogenation has been tried under varying conditions to improve the refining qualities of shale oil, and high-pressure hydrogenation will be studied when equipment becomes available. Themal cracking, catalytic cracking, and chemical and catalytic treatment of cracked products are being studied.

At the Rifle plant, a refining unit with a charging capacity of approximately 200 barrels of shale oil a day, is expected to be in operation soon. The single-coil tube still has been designed for flexibility of operating conditions, comprising distillation at atmospheric pressure, viscosity breaking, thermal cracking, and reforming and coking. The treating plant is based upon 3-stage, low-temperature, acid treatment and doctor sweetening.

Future Prospects

Apparently it is still true, as it was ten years ago, that the people of the U. S. in their individual capacities (as distinguished from organized transportation systems, for example) are the major users of petroleum products[13]. The large increase in demand for petroleum products in this country since the end of World War II indicates that our citizens want to use more and more gasoline and domestic heating oil, and it seems likely that the total demand for liquid fuels and similar products will continue to increase. If that assumption is sound, it seems altogether likely that in the course of time there will be a place for oil shale in the liquid fuel supply situation to the extent at least, of 1 to 2 million barrels of products a day, and that a productive capacity of that order can be added to the present capacity to produce liquid fuels without adverse effect upon the petroleum and natural gas industries.

One of the present deterrents to even greater increase in demand for domestic heating oil is the question in the minds of householders regarding future availability of the fuel. As has been shown, the management of an oil-shale plant in western Colorado can plan and schedule operations for 20 years or more in advance, with accurate knowledge of where the raw materials (oil shale) is to come from, and at what cost. There is enough shale in known deposits to supply all demands for many years. This cushion of assured productive capacity would have a beneficial effect upon the petroleum and natural gas industries, rather than the reverse.

The large-scale operations that are being developed and demonstrated in the Bureau's oil-shale program give promise of providing products from oil shale at costs that will be less than was thought possible by many people when the program was started.

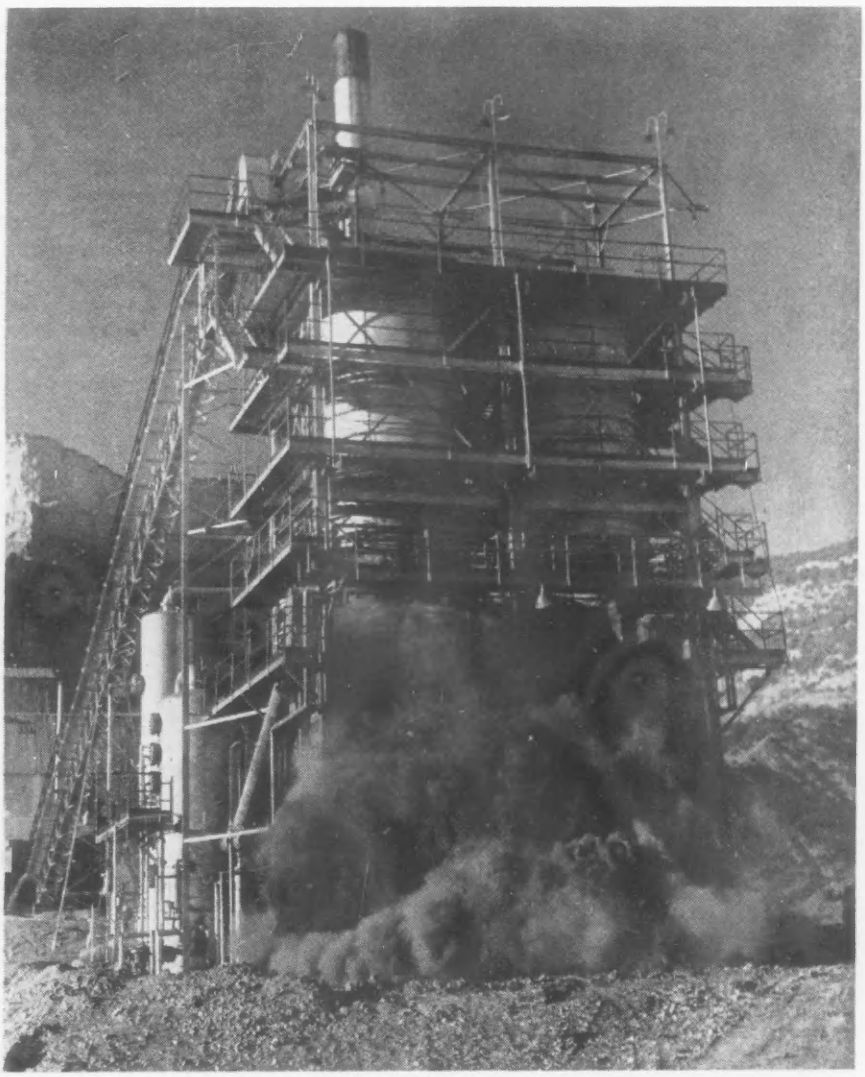


FIGURE 6. Thirty-five tons of spent shale is dumped on ground at end of run in N-T-U retort at Demonstration Plant, Rifle, Colo.

REFERENCES

[1] Hearings before a Subcommittee of the Committee on Interstate and Foreign Commerce, "Cole Committee," House of Representatives, 73rd Congress, Recess, on H. Res. 441, Petroleum Investigation, Part 2, pp. 881-82, Govt. Printing Office, (1934).

[2] Bacon, R. F., and Hamor, W. A., The American Petroleum Industry, Vol. 1, pp. 203-211, McGraw-Hill Book Co. (1916).

[3] American Society for Testing Materials, Standard Definitions of Terms Relating to Petroleum: ASTM Designation D288-47, 1947 Supplement to Book of ASTM Standards, Part III-A, Nonmetallic Materials, pp. 33-34.

[4] Gavin, M. J., Oil Shale: An Historical, Technical, and Economic Study: Bull. 210, Bureau of Mines, 1922, 201 pp.

[5] Winchester, Dean E., The Oil Possibilities of the Oil Shales of the United States: Federal Oil Conservation Board to the President of the United States, Appendix I, Rept. II, January 1928, Washington, D. C. 1928.

[6] Belser, Carl, Oil Shale Resources of Colorado, Utah and Wyoming: Tech. Pub. No. 2358, Am. Inst. Min. Met. Engrs. May, 1948, 11 pp.

[7] Gardner, E. D., Mining Program, Bureau of Mines Oil-Shale Project, Rifle, Colorado: Rept. of Investigations 4269, Bureau of Mines, April 1948, 19 pp.

[8] Klosky, Simon, A Century of Oil Shale Patents (1845 to 1945): Chem. Eng. News, vol. 24, pp. 2342-44, Sept. 10, 1946.

[9] Oil Shale and Cannel Coal: Proceedings of a Conference held in Scotland, June 1938, The Institute of Petroleum, London, 1938, xix 476 pp.

[10] Stelling, Robert, Oil Shales and Torbanite: The Industrial Chemist (London), vol. 19, Nos. 218, 219, 220, March, April, and May, 1943.

[11] Lankford, J. D., and Guthrie, Boyd, Oil Shale Processing: Tech. Pub. No. 2360, Am. Inst. Min. Met. Engrs., May, 1948, 12 pp.

[12] Murphree, E. V., Natural Gas, Coal, Oil Shale as Sources of Liquid Fuels: Oil and Gas Jour., vol. 46, No. 49, pp. 66, 68-70, 95, April 8, 1948.

[13] Kraemer, A. J., and Thorne, H. M., Manufacture and Use of Petroleum Products (A Review of Developments, 1934-38), Report published in Hearing before a Subcommittee of the Committee on Interstate and Foreign Commerce, House of Representatives, 76th Congress on H. Res. 290 and H. R. 7372, Part 1, pp. 210-286, Nov. 1939.

"Without This Log we'd have had a dry hole!"

Opelousas, La. [redacted]

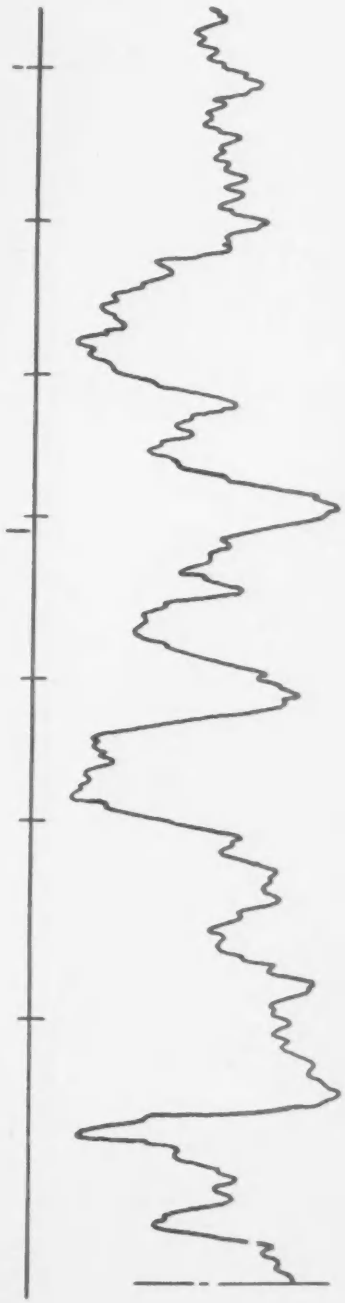
eport on [redacted]

This well had been drilled to contract depth. We were called in because seven electrical surveys did not check with other well measurements.

Ran Gamma Ray and Collar Log Survey to tie down formations to bench marks. Log showed 17-foot measure discrepancy in electrical surveys. Well was gun-perforated accurately from collars, with 72 holes. Completed for an I. P. 210 BOPD, 46.3° gravity, through 1/8" choke.

Operator says, "Without this Log, we would have had a dry hole." Says he is sold on Lane-Wells Radioactivity Well Log from here on.

Signed [redacted]



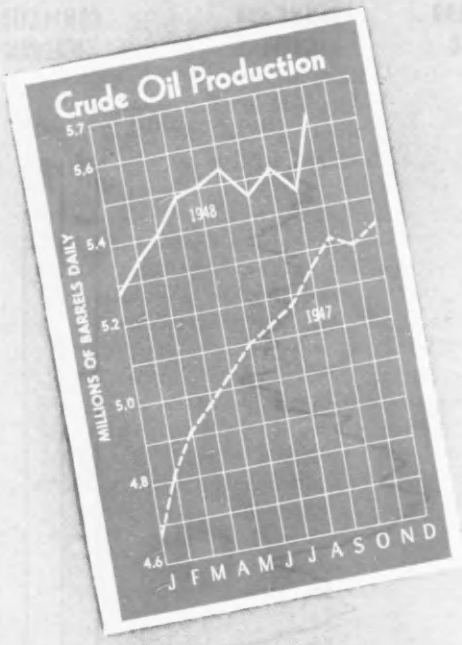
To be *Sure* of formation depths and characteristics

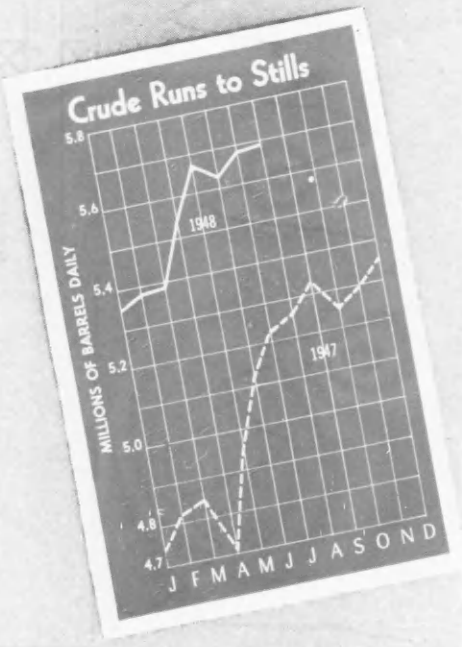
Run a

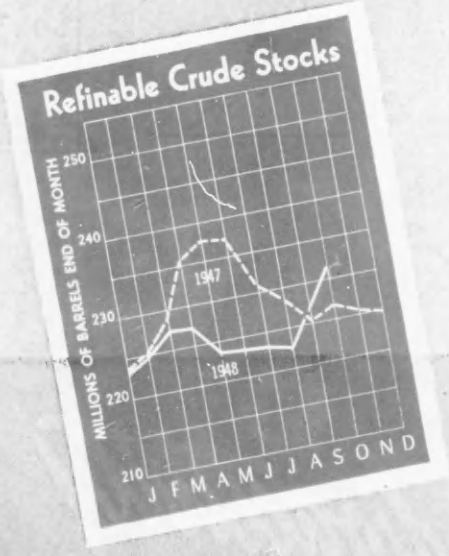
LANE WELLS — TECHNICAL OILFIELD SERVICES

Radioactivity **WELL LOG**

General Offices, Export Offices and Plant
5610 S. Soto St., Los Angeles 11, Calif.







Petroleum

Crude Stocks at Highest

By CECIL SMITH,

CRUDE production in the U. S. hit an all-time peak during October, enabling crude stocks to reach their highest level since the middle of last year. Not all of the stocks' increase was attributable to stepped-up output, as part was due to curtailed refinery operations resulting from the West Coast oil workers' strike. This strike also included production workers, but the affected companies were far more successful in getting strikers to return to the oil fields than to their refineries. As a result California's oil production was back to near normal several weeks before normalcy returned to refinery operations shortly after the end of October.

Heating oil stocks continued to make heavy gains and at the end of the month distillate fuel oil inventories were the highest in history. Another factor that makes the outlook for the winter season even brighter is that these large stocks are fairly well distributed. By the end of the month, gasoline production and demand seemed to be near stabilization and stocks of this product were making starts toward higher ground.

Production from U. S. oil fields averaged 5,621,000 barrels daily during

Crude Oil and Refined Products Trends

(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month
1945:									
January	4,756	4,680	221,737	2,094	91,666	663	31,695	1,350	44,347
February	4,767	4,817	220,221	2,194	97,457	724	27,210	1,326	39,760
March	4,804	4,719	223,988	2,124	97,447	675	26,729	1,273	35,451
April	4,807	4,774	224,229	2,127	90,804	681	29,148	1,289	34,418
May	4,887	4,913	223,151	2,179	88,530	708	29,511	1,341	34,333
June	4,859	4,989	218,218	2,166	86,128	730	32,440	1,351	35,606
July	4,897	5,001	216,638	2,281	85,582	713	36,276	1,351	38,341
August	4,870	4,928	215,135	2,269	84,003	701	41,245	1,329	42,227
September	4,423	4,275	220,319	1,933	74,574	640	45,059	1,139	42,822
October	4,284	4,244	221,246	1,888	76,805	613	45,479	1,176	42,008
November	4,517	4,624	218,916	2,156	86,540	665	44,562	1,265	41,322
December	4,472	4,574	218,763	2,056	97,676	683	35,778	1,245	37,158
1946:									
January	4,625	4,520	223,442	1,914	102,394	787	28,990	1,224	34,573
February	4,719	4,651	227,220	1,884	104,836	823	25,511	1,243	34,008
March	4,414	4,661	221,400	1,900	104,161	815	29,922	1,213	32,995
April	4,673	4,663	222,480	1,943	98,744	773	32,064	1,247	35,206
May	4,785	4,794	221,592	2,016	93,960	753	33,385	1,220	38,932
June	4,896	4,836	223,140	2,055	91,971	777	38,824	1,219	41,492
July	4,922	4,856	224,351	2,102	87,778	793	46,439	1,163	45,446
August	4,836	4,856	224,157	2,189	86,745	765	54,068	1,159	48,186
September	4,790	4,839	222,417	2,143	87,021	796	62,019	1,150	54,012
October	4,785	4,736	222,177	2,117	85,952	788	70,780	1,090	55,580
November	4,823	4,684	226,453	2,162	88,587	791	68,145	1,101	52,735
December	4,725	4,789	224,473	2,168	92,742	805	59,912	1,159	47,094
1947:									
January	4,671	4,739	223,848	2,078	99,623	778	48,197	1,174	41,550
February	4,810	4,820	225,121	2,089	103,672	777	36,901	1,228	48,480
March	4,908	4,843	228,981	2,076	105,679	825	31,423	1,222	37,403
April	4,974	4,707	235,710	2,037	101,724	764	30,268	1,148	36,455
May	5,033	4,947	237,768	2,128	95,209	805	34,279	1,204	39,992
June	5,099	5,120	237,278	2,258	89,774	807	39,676	1,233	43,515
July	5,137	5,221	230,974	2,302	86,003	847	46,444	1,244	47,600
August	5,173	5,260	228,523	2,383	85,849	809	54,707	1,245	51,334
September	5,251	5,236	225,258	2,375	84,360	911	59,764	1,237	52,578
October	5,320	5,253	226,666	2,371	82,584	938	63,252	1,260	52,502
November	5,291	5,291	225,462	2,332	87,551	942	61,334	1,245	52,455
December	5,337	5,350	224,929	2,347	92,303	992	51,081	1,282	47,091
1948:									
January	5,283	5,348	223,430	2,328	102,167	1,082	41,036	1,278	44,636
February	5,353	5,380	224,880	2,264	110,999	1,127	34,590	1,295	43,156
March	5,406	5,387	227,408	2,252	111,949	1,050	32,214	1,307	41,945
April	5,484	5,540	227,278	2,396	109,829	978	34,514	1,303	43,301
May	5,502	5,668	223,820	2,486	108,552	992	40,781	1,314	48,518
June	5,544	5,632	223,481	2,529	104,518	998	48,352	1,280	52,465
July	5,522	5,631	223,124	2,494	98,839	994	58,725	1,264	58,431
August	5,577	5,621	224,211	2,532	95,445	1,038	68,818	1,248	64,096
September	5,422	*	226,631	*	91,318	*	76,892	*	68,098
October	5,621	5,581	231,006	2,474	91,847	1,062	81,815	1,287	72,214
October, 1948: Changes:									
In Month	+199	*	+4,375	*	+529	*	+4,923	*	+4,116
In One Year	+301	+328	+4,340	+103	+9,263	+124	+18,563	+27	+19,712
In Two Years	+836	+845	+8,829	+357	+5,895	+274	+5,035	+197	+16,634

* Not available because of California strike.

Trends

Peak Since Middle 1947

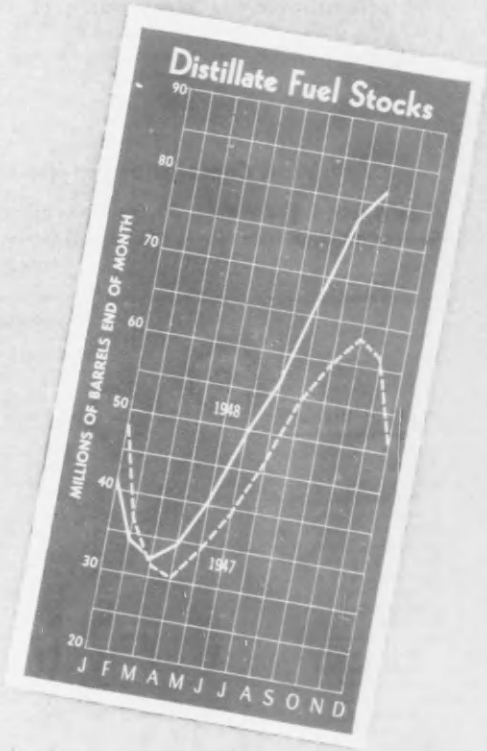
Staff Writer

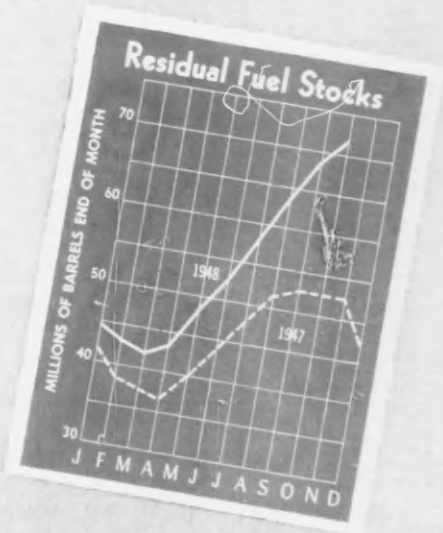
October to set a new all-time peak. That was an increase of 199,000 barrels a day over output during September, the period during which California's production was most sharply cut. The previous crude production record had been 5,577,000 barrels daily in August of this year. Daily production in October of last year averaged 5,320,000 barrels.

As a result of increased production and cut-back refinery runs, refinable crude stocks rose to their highest level since June, 1947. The gain during the month amounted to 4,375,000 barrels and boosted the U. S. total to 231,006,000 barrels.

Runs to refinery stills averaged 5,581,000 barrels a day during October, a lower rate than was maintained during the mid-summer months. September's data is not available due to the West Coast refinery shutdown; therefore, no comparison can be made with that month. However, October's refinery runs of 5,581,000 a day failed to match August's and July's average runs of 5,631,000 and 5,621,000 barrels, respectively. A year ago refineries charged their stills with an average of 5,253,000 barrels a day.

Manufacture of gasoline, including natural gasoline blended, was lower during October than it was in August, but still stocks showed a small increase for the first time this season. A gain of 529,000 barrels during the month raised stocks of finished and unfinished gasoline to a grand total of 91,847,000 barrels. That amount was 9,263,000 barrels more than was in storage a year earlier. This product is now at the point of the year when production more than takes care of market needs and stocks can start to build for the heavy motoring season that will come next spring.





State Crude Oil Production

(THOUSANDS OF BARRELS)

STATE OR DISTRICT	DAILY AVERAGE PRODUCTION				TOTAL FIRST TEN MONTHS		
	October, 1948	Sept., 1948	October, 1947	% Diff. October, '47-'48	1948	1947	% Diff. '47-'48
Alabama	1.4	1.4	1.3	+ 7.7	394	320	+ 23.1
Arkansas	86.1	87.3	84.7	+ 1.7	26,263	24,756	+ 6.1
California	932.9	781.1	921.5	+ 1.2	282,320	276,472	+ 2.1
Colorado	48.5	49.7	47.9	+ 1.3	14,197	12,915	+ 9.9
Florida	0.8	0.6	0.7	+ 14.3	235	212	+ 10.8
Illinois	181.1	181.6	180.7	+ 0.3	53,794	55,631	— 3.3
Indiana	25.9	24.6	14.4	+ 79.9	5,581	4,987	+ 11.9
Kansas	301.7	302.2	301.2	+ 0.2	91,515	87,495	+ 4.6
Kentucky	24.4	25.0	27.2	— 10.3	7,198	7,809	— 7.8
Louisiana	497.5	499.0	455.6	+ 9.2	149,328	131,680	+ 13.4
North Louisiana	115.6	116.9	101.6	+ 13.8	35,631	29,885	+ 19.2
South Louisiana	381.9	382.1	354.0	+ 7.9	113,697	101,795	+ 11.7
Michigan	46.4	46.1	47.4	— 2.1	13,867	13,384	+ 3.6
Mississippi	129.1	129.1	107.3	+ 20.3	37,829	28,458	+ 32.9
Missouri	0.2	0.2	0.2	.....	45	45	.....
Montana	25.6	25.2	24.9	+ 2.8	7,720	7,198	+ 7.3
Nebraska	0.4	0.4	0.6	— 33.3	181	188	— 3.7
New Mexico	133.5	132.3	122.8	+ 8.7	39,593	33,634	+ 17.7
New York	14.0	14.0	13.4	+ 4.5	3,947	3,982	— 0.9
Ohio	9.4	9.8	9.4	.....	2,773	2,573	+ 7.8
Oklahoma	433.0	429.0	405.5	+ 6.8	126,997	116,310	+ 9.2
Pennsylvania	32.7	32.8	36.1	— 9.4	10,506	10,612	— 1.0
Tennessee	.....	.....	.....	.....	6	7	— 14.3
Texas	2,527.6	2,485.2	2,377.9	+ 6.3	747,163	674,995	+ 10.7
Dist. 1—South Central	28.5	28.8	24.4	+ 16.8	8,337	6,613	+ 26.1
Dist. 2—Middle Gulf	181.8	181.7	162.1	+ 12.2	53,327	47,348	+ 12.6
Dist. 3—Upper Gulf	516.8	507.0	492.7	+ 4.9	151,838	145,094	+ 4.1
Dist 4—Lower Gulf-S.W.	256.6	253.0	259.5	— 1.1	77,404	72,485	+ 6.8
Dist. 5—East Central	51.4	49.5	41.1	+ 25.1	14,326	11,720	+ 22.2
Dist. 6—Northeast	427.6	433.1	438.1	— 2.4	131,275	132,157	— 0.7
Dist 7-B—North Central	57.5	52.6	43.7	+ 31.6	14,626	11,632	+ 25.7
Dist. 7-C—West Central	47.8	44.9	40.7	+ 17.4	13,595	11,172	+ 21.7
Dist. 8—West	728.6	707.8	645.7	+ 12.8	210,021	166,539	+ 26.1
Dist. 9—North	142.4	140.0	135.9	+ 4.8	42,572	39,713	+ 7.2
Dist 10—Panhandle	88.5	86.8	89.1	— 0.7	26,445	25,896	+ 2.1
Utah	0.2	.....	.....	.....	6	.....	.....
Virginia	0.1	0.1	0.1	.....	31	59	— 47.5
West Virginia	8.1	7.3	8.2	— 1.2	2,250	2,171	+ 3.6
Wyoming	160.7	158.1	130.8	+ 22.9	45,276	36,035	+ 25.6
Total United States	5,621.4	5,422.0	5,319.8	+ 5.7	1,669,015	1,531,928	+ 8.9

Completions

Highest in History for October

OCTOBER was the most active month in the industry's history as far as well completions were concerned. The month's 3936 wells topped the previous record of 3811 completions in August and boosted the year's ten-month total to a lead of 17.4 percent over the same period of 1947.

Through October, 32,436 wells had been drilled as compared with 27,633 in the same ten months of last year. These totals include old wells that were deepened and, after omitting these, the new wells numbered 32,003 for 1948 and 27,068 a year ago. As total new wells drilled last year amounted to 33,013, it can be seen that this year's work will pass that mark by mid-November and then go on to establish a new all-time record in wells completed.

The greatest number of wells completed in any year was slightly over 35,000 in 1937. This record has stood for almost 11 years, but there can be no doubt that when the final count is made at the end of 1948 a new mark will have been set. Not only will nearly 4000 more wells be drilled in 1948 than during that record year, but each well will be almost 500 feet deeper on the average.

At the close of October there was a record high of 5233 rigs working in the U. S., which insures that drilling will continue at a rapid pace at least for the remainder of the year. A year ago active rigs numbered 4897 in the U. S.

So far this year almost 111 million feet of hole have been drilled compared with slightly over 113 million in all of last year, which was the greatest amount ever drilled.

Well Completions in the United States During October, 1948, and Cumulative for Year

(Figures compiled by WORLD OIL Staff from private reports and other sources as follows: Illinois from Illinois Geological Survey; Indiana Division of Geology; Missouri from Missouri Geological Survey; Tennessee from Tennessee Division of Geology; Bradford, Kane-Clarendon, and Allegany fields of Pennsylvania and New York from The Producers Monthly.)

STATE OR DISTRICT	MONTHLY COMPLETIONS, OCTOBER, 1948									TOTAL COMPLETIONS				CUMULATIVE TOTAL				Rigs in Operation (Drilling, Rigging Up and Shut Down)		
	NEW WELLS																			
	Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Total New	Total Drilled Deeper	Oct., 1948	Sept., 1948	Oct., 1947	Footage October, 1948	Wells 1948	Wells 1947	Percent Diff.	Footage 1948	Oct. 31, 1948	Sept. 30, 1948	Oct. 31, 1947
Alabama				3				3		3		4	21,028	16	23	— 30.4	87,589	6	5	6
Arizona														1			630	6	7	
Arkansas	11	1	1	18				31		31	26	47	123,359	265	262	+ 1.1	1,060,249	34	35	37
California	189		3	63				255	4	259	195	194	979,878	2,206	1,609	+ 37.1	7,740,324	288	282	273
Colorado	8		3	4				15		15	10	23	77,508	184	169	+ 8.9	992,388	34	45	72
Florida				4				4		4	1	3	28,703	24	27	— 11.1	151,874	4	4	5
Georgia														3	3		13,781			1
Illinois	149			153				302		302	218	190	788,357	2,045	1,691	+ 20.9	5,351,465	297	279	229
Indiana	52			47				99		99	112	80	204,952	874	511	+ 71.0	1,662,623	135	126	79
Kansas	150		35	102			5	292		292	217	319	1,126,156	2,493	2,174	+ 14.7	8,371,221	314	313	348
Kentucky	27		23	21				71		71	64	67	152,728	651	710	— 8.3	1,295,593	80	76	99
Louisiana	135	13	14	65				227		227	190	188	1,078,771	1,858	1,321	+ 40.7	8,976,717	235	209	198
North Louisiana	109	6	8	38				161		161	146	134	465,515	1,229	800	+ 53.6	3,328,368	77	66	76
South Louisiana	26	7	6	27				66		66	44	54	613,256	629	521	+ 20.7	5,648,349	158	143	122
Maryland														1			5,259			1
Michigan	49		3	38				90		90	56	83	193,342	615	581	+ 5.9	1,406,811	122	125	133
Mississippi	27	3	1	23				54		54	29	54	371,362	360	398	— 9.5	2,804,409	50	52	69
Missouri	3			6				9		9	1	7	4,267	48	35	+ 37.1	17,020	8	8	6
Montana	24		1	7				32		32	25	30	70,003	255	187	+ 36.4	607,501	66	61	77
Nebraska														1	3	— 66.7	4,965			4
Nevada																		1	1	
New Mexico	41		2	23				66		66	32	44	266,343	514	479	+ 7.3	2,091,111	129	139	124
New York	98		3	1	62			164		164	170	185	239,091	1,531	1,527	+ 0.3	2,205,890	200	213	228
North Carolina															1	—100.0				
North Dakota																		1		
Ohio	45		38	47				130	4	134	135	131	315,389	1,129	1,117	+ 1.1	2,797,076	199	206	262
Oklahoma	246		32	149	1	1	3	432	9	441	320	296	1,592,424	3,490	3,083	+ 13.2	12,482,028	525	553	506
Oregon															1	—100.0				
Pennsylvania	111		46	12	104	16		289	2	291	312	329	505,692	2,783	2,902	— 4.1	4,830,584	412	425	421
South Dakota														1			1,365	2	1	1
Tennessee				4				4		4	2		3,850	38	13	+192.3	48,595	14	14	11
Texas	755	15	36	367	1	1	1	1,176	29	1,205	900	912	5,148,264	9,908	7,873	+ 25.8	42,095,112	1,527	1,394	1,247
Dist. 1—S. Central	26		1	29				56	2	58	47	60	150,322	417	304	+ 37.2	1,248,332	36	25	49
Dist. 2—Middle Gulf	38	2	3	26				69	1	70	48	59	419,529	624	527	+ 18.4	3,646,635	64	63	68
Dist. 3—Upper Gulf	63	7	3	38				111	1	112	73	95	714,815	896	721	+ 24.3	5,767,693	148	137	112
Dist. 4—L. Gulf-SW	77	5	3	54				139	7	146	100	113	677,182	1,162	938	+ 23.9	5,505,650	144	119	119
Dist. 5—E. Central	15	1	1	15				32		32	13	23	147,058	190	137	+ 38.7	918,946	31	22	28
Dist. 6—Northeast	23		8	10			1	42		42	33	55	230,656	329	416	— 20.9	1,768,106	53	43	60
Dist. 7-B—N. Central	83		4	68				155	1	156	107	88	519,836	1,186	746	+ 59.0	3,741,864	202	212	106
Dist. 7-C—W. Central	20			10				30		30	37	24	129,232	336	232	+ 44.8	1,439,208	79	61	54
Dist. 8—West	258		1	29				288	15	303	235	183	1,438,981	2,464	1,649	+ 49.4	11,402,184	474	439	422
Dist. 9—North	104			84	1	1		190	2	192	154	161	579,818	1,831	1,781	+ 2.8	5,134,886	127	122	100
Dist. 10—Panhandle	48		12	4				64		64	53	51	200,835	473	422	+ 12.1	1,521,608	169	151	120
Utah				1				1		1	1		4,493	17	3	+466.7	69,239	13	10	12
Virginia														1			2,301			
Washington												1		2	1	+100.0	11,205			1
West Virginia	20		56	17				93	1	94	72	73	247,319	695	719	— 3.3	1,786,475	378	392	365
Wyoming	34		1	9				44	4	48	40	37	193,708	427	210	+103.3	1,726,289	153	141	82
Total United States	2,174	32	298	1,184	168	18	9	3,883	53	3,936	3,128	3,297	13,737,287	32,436	27,633	+ 17.4	110,697,689	5,233	5,116	4,897

. . . because it conditions mud in a hurry

MAGCOGEL makes for faster, safer more economical drilling

Since MAGCOGEL . . . a concentrated colloidal material for drilling mud . . . is especially processed and ground uniformly finer than other bentonites, it is completely dispersed and quickly hydrated so that its effect on wall building and gel properties is present as soon as the mud enters the hole.

Mixed with water alone, it makes a low-per-barrel-cost mud having all of the desirable properties required of a good drilling fluid except weight.

MAGCOGEL is made from the finest, carefully selected Wyoming Bentonite. It's stocked by more than 200 MAGCOBAR dealers from the Rockies to Florida.

Magnet Cove Barium Corporation

Malvern, Arkansas — Houston, Texas

Export: Guy E. Daniels,
30 Rockefeller Plaza, New York City, N. Y.

Magcobar
Complete
DRILLING MUD SERVICE
DEALER

Look for this sign WHEN YOU NEED MUD

MAGCOBAR • MAGCOGEL • HIGH YIELD DRILLING MUD • XACT CLAY • FIBER-SEAL • MAGCO-MICA • TANNATHIN • JEL-OIL MUD • JEL-OIL "E" • SALT GEL NOHEEV • SEAL FLAKES • MY-LO-JEL • CHEMICALS

Exploration

In 10 Months Exceeds All of 1947

Summary of Results of Exploratory Drilling

ITEM	Oct., 1948	Sept., 1948	TEN MONTHS: Jan.- Oct. 1948	1947	Percent Diff.
Oil Discoveries	82	73	735	586	+ 25.4
New Fields	56	50	495	345	+ 43.5
New Pays	26	23	240	241	— 0.4
Distillate Discoveries	11	10	85	85	
New Fields	7	8	50	38	+ 31.6
New Pays	4	2	35	47	— 25.5
Gas Discoveries	8	19	117	99	+ 18.1
New Fields	5	13	84	74	+ 13.5
New Pays	3	6	33	25	+ 32.0
Total Discoveries	101	102	937	770	+ 21.7
Extensions to Fields	30	19	182	155	+ 17.4
Oil Fields	26	10	147	117	+ 25.6
Distillate Fields	2	4	14	15	— 6.6
Gas Fields	2	5	21	23	— 8.7
Total Prod. Tests	131	121	1,119	925	+ 20.9
Dry Holes	513	460	4,486	3,590	+ 25.0
Wildcats	501	456	4,422	3,483	+ 27.0
New Pays	1	3	11	49	— 77.6
Outposts	11	1	53	58	— 8.6
Total Expl'tory Tests	644	581	5,605	4,515	+ 24.1
Percent Productive	20.3	20.8	20.0	20.5	
Percent Dry	79.7	79.2	80.0	79.5	

In THE first ten months of this year more exploratory wells were completed than in all of 1947. Last year the industry set an all-time high mark in this class of drilling operations by completing slightly fewer than 5600 wells, but by the end of October of this year that mark had been passed. With two months to go and with current drilling operations at peak levels, this year's total should top the 1947 record by more than 1200 wells.

So far this year, exploratory completions total 5605 compared with 4515 for first ten months of 1947. Of these operations, 1119 were completed successfully in 1948 for a score of 20 percent of the total, while 925 producers amounted to 20.5 percent in last year's period. October added 644 tests to the year's record and contributed 131 producers to show a slightly higher rate of success than the average for the year.

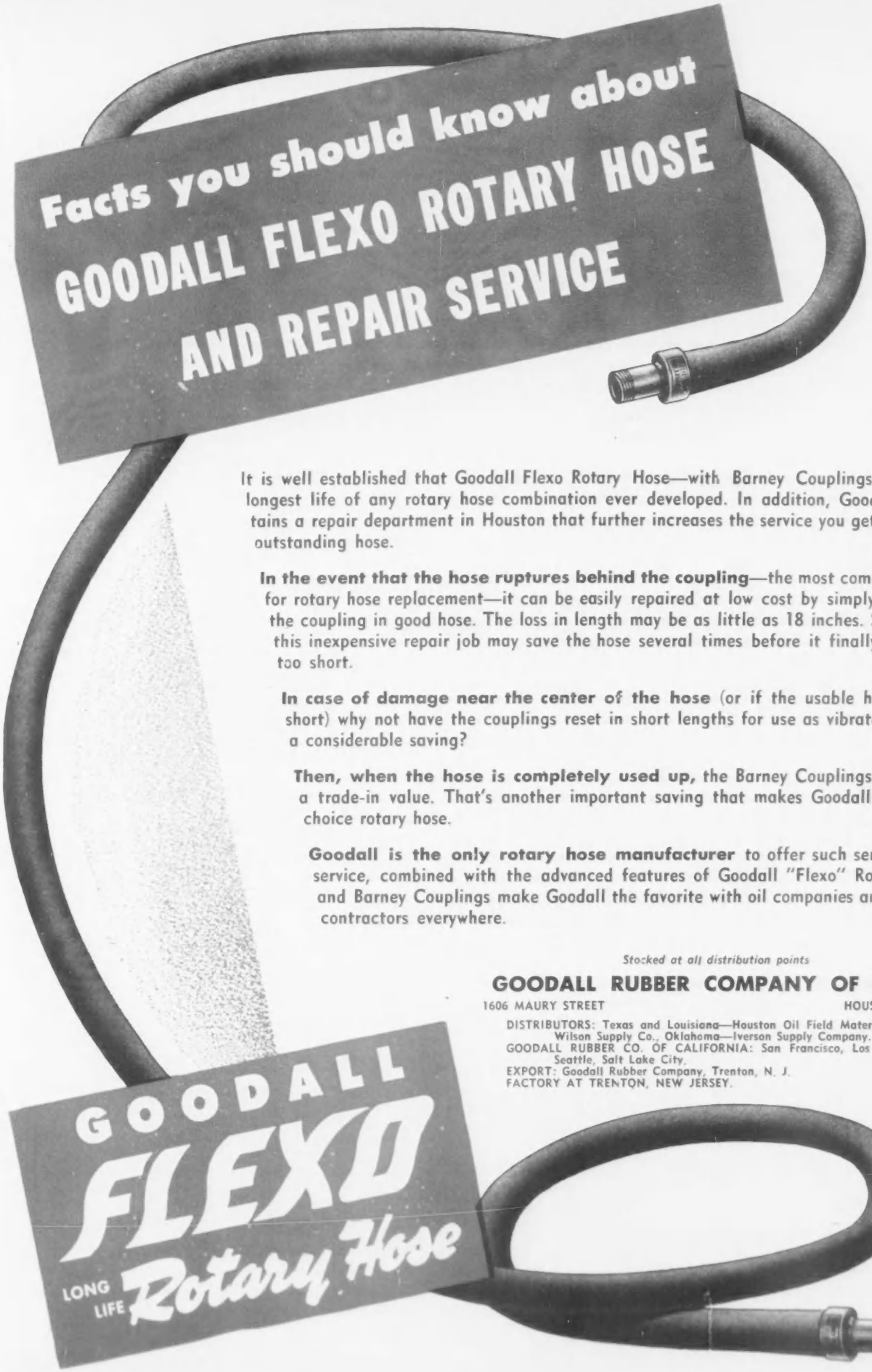
Included in October's successful wildcats were two wells that have apparently made major discoveries in the Rocky Mountain Region, one each in Wyoming and Montana.

Amerada Petroleum Corporation, in its first discovery in the Rocky Mountains, has opened a new area that may prove to be one of the best uncovered in Montana. On a General Petroleum Corporation farmout, Amerada completed its

Results of Exploratory Drilling in October and First 10 Months, 1948-47, by Districts

State or District	MONTH OF OCTOBER, 1948													FIRST TEN MONTHS, 1948																	
	Productive Tests									Total Productive	Unproductive Tests			Total Exploratory Tests	Productive Tests									Unproductive Tests				Total Exploratory Tests	
	New Fields			New Pays			Extensions								New Fields			New Pays			Extensions			Total Productive				Total Dry			
	Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas		Wildcats	New Pays	Outposts		Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas	10 Mo. 1948	10 Mo. 1947	Wildcats	New Pays	Outposts	10 Mo. 1948	10 Mo. 1947	10 Mo. 1948	10 Mo. 1947
Alabama											3			3												17			17	17	17	17
Arizona																										1			1			
Arkansas				1						1	13			14	6			1						7	9	89			89	57	96	66
California				1			4			5	15			20	15		1	7			22	1	1	47	30	173	1		174	227	221	257
Colorado	1								1	2	3			5	2		1	1					2	6	6	45			45	36	51	42
Florida											4			4	1									1		21			21	25	22	25
Georgia																										3			3	3	3	3
Illinois	3			3			7			13	68			81	22			23		1	38			84	120	447			447	352	531	472
Indiana	5			1			1			7	17			24	26		1	4			7			38	17	200			200	110	238	127
Kansas	8		2				1			11	51			62	58		5	2			3			68	62	393	1		394	295	462	357
Kentucky											2			2	4		1	1			1			7	7	46			46	45	53	52
Lousiana	2	4	1	1	3				1	12	23			35	15	16	7	38	14	2	4	4	2	102	74	194		1	195	228	298	302
North Louisiana	2	2	1		1					6	18			24	7	3	4	2	1		3	2	1	23	15	104			104	158	127	173
South Louisiana		2		1	2				1	6	5			11	8	13	2	36	13	2	1	2	2	80	59	90		1	91	70	171	129
Maryland																										1			1		1	
Michigan	1			1			1			3	14			17	9		4	2			3			18	15	202			202	181	220	199
Mississippi								1		1	14		1	16	2	1					2	1		6	9	89		2	91	75	97	84
Missouri											6			6												20			20	15	20	15
Montana	1									1	2		1	4	3			1			1			5	5	25		1	26	14	31	19
Nebraska																														2		2
New Mexico	1									1	15			16	7	1	2	5		1				16	8	68			68	53	84	61
North Carolina																										1			1			
Ohio											3			3	1						1		8	11	8	32			33	38	44	46
Oklahoma	8			3						11	34			45	52	2	16	22		1	4			97	92	384		2	386	455	483	548
Oregon																														1		1
Pennsylvania											1			1												4			4	3	4	3
South Dakota																										1			1			
Tennessee											4			4	1									1		29			29	12	30	12
Texas	24	3	1	14	1	3	12	1		59	201	1	9	270	256	30	34	120	21	28	57	7	7	560	442	1858	8	45	1911	1291	2471	1733
Dist. 1 S. Central	1									1	24		1	26	5			1		1				7	14	160		1	161	116	168	130
Dist. 2 Middle Gulf		1	1	2			1			5	17		1	23	12	6	6	16	8	6	4	4	1	63	58	149	1	7	157	100	220	158
Dist. 3 Upper Gulf	1			8		3	2	1		15	21	1	1	38	15	9	4	47	5	10	7	2	4	102	74	218	3	4	225	151	328	225
Dist. 4 L. Gulf-SW	4	2		2	1		2			11	27		4	42	24	12	5	20	8	11	6	1	1	88	101	263	1	20	284	208	372	309
Dist. 5 E. Central											10			10	4			2			1			7	10	75			75	61	82	71
Dist. 6 Northeast	1			1						2	2			5	6	3		5			5			19	13	53	2		55	46	74	59
Dist. 7-B N. Central	9						1			10	41			51	80		12	14			5			111	66	348		1	349	208	460	268
Dist. 7-C W. Cent.	1									1	4			5	10		1	2			2			21	10	73		1	74	32	95	51
Dist. 8—West	3						3			6	16		2	24	50		4	4			16		1	75	42	147	1	7	155	112	230	155
Dist. 9 North	4			1			3			8	36			44	44		1	9			11			65	48	367		4	371	238	436	286
Dist. 10 Panhandle											2			2			1							1	2	5			5	19	6	21
Utah											1			1	1			3						4		13			13	3	17	3
Virginia																		1						1							1	
Washington																										2			2	1	2	1
West Virginia											1			1				4						4	3	4			4	7	8	10
Wyoming	2		1	1						4	5			9	14			33	13		4	1		35	17	60	1	2	63	40	98	57
Total U. S.	56	7	5	26	4	3	26	2	2	131	501	1	11	644	495	50	84	340	35	33	147	14	21	1119	925	4422	11	53	4486	3590	5605	4515

Facts you should know about GOODALL FLEXO ROTARY HOSE AND REPAIR SERVICE



It is well established that Goodall Flexo Rotary Hose—with Barney Couplings—has the longest life of any rotary hose combination ever developed. In addition, Goodall maintains a repair department in Houston that further increases the service you get from this outstanding hose.

In the event that the hose ruptures behind the coupling—the most common cause for rotary hose replacement—it can be easily repaired at low cost by simply resetting the coupling in good hose. The loss in length may be as little as 18 inches. Sometimes this inexpensive repair job may save the hose several times before it finally becomes too short.

In case of damage near the center of the hose (or if the usable hose is too short) why not have the couplings reset in short lengths for use as vibrator hose at a considerable saving?

Then, when the hose is completely used up, the Barney Couplings still have a trade-in value. That's another important saving that makes Goodall the first-choice rotary hose.

Goodall is the only rotary hose manufacturer to offer such service. This service, combined with the advanced features of Goodall "Flexo" Rotary Hose and Barney Couplings make Goodall the favorite with oil companies and drilling contractors everywhere.

Stocked at all distribution points

GOODALL RUBBER COMPANY OF TEXAS

1606 MAURY STREET HOUSTON, TEXAS

DISTRIBUTORS: Texas and Louisiana—Houston Oil Field Material Co.—Wilson Supply Co., Oklahoma—Iverson Supply Company.
GOODALL RUBBER CO. OF CALIFORNIA: San Francisco, Los Angeles, Seattle, Salt Lake City.
EXPORT: Goodall Rubber Company, Trenton, N. J.
FACTORY AT TRENTON, NEW JERSEY.

Hougen 1, Melstone area, Musselshell County, with a flowing gauge of 655 barrels per day through three-fourth-inch choke. Production is from the Kibbey sand at 4185-229 feet, and this is the first flowing Kibbey well in the state.

This discovery is approximately 16 miles due east of the Big Wall field where The Texas Company opened commercial possibilities in the Basal Amsden sand to provide a second pay zone in addition to the Kibbey, the field's original pay. This well, not yet officially completed, has been rated at about 840 barrels a day. As a result of Amerada's new field discovery and Texas' Big Wall find, leasing is active over a wide area in central Montana.

Joining Wyoming's major finds of 1948 was Clark Drilling Company and Big Horn-Powder River Corporation's discovery at Fiddler Creek, Weston County, with Whitzel No. 1. This well, regarded as the most important Powder River basin discovery this year, made test flow of 1275 barrels per day from the Newcastle (Muddy) sand at 4502-52 feet. After completion, output settled to 648 barrels through three-fourth-inch choke.

Another Wyoming discovery, six miles south of the Fiddler Creek well, was made by Sierra Petroleum, Inc., with Kummerle 1. Production is being pumped from the Dakota sand, but it contains a large water cut.

Another gas-condensate field has been reported opened in the Gulf of Mexico off Louisiana. The new tidelands discovery is Magnolia Petroleum Company's State Lease 838, No. 1, Block 45, Eugene Island area, 12 miles from land. On a three-eighth-inch choke, the well flowed 60 barrels of condensate and 1¼ million cubic feet of gas from a sand topped at 11,351 feet.

New Oil, Distillate and Gas Fields and New Pay Horizons Discovered in the United States in October, 1948

Also Important Extensions to Established Fields

COUNTY	FIELD	COMPANY, WELL AND LOCATION	Date Completed	Total Depth (Feet)	Completion Horizon (Feet)	[1]Name, Character and Age of Producing Formation	[2]Initial Production Method and Choke	Gravity of Oil
		ARKANSAS—New Oil Pay						
Lafayette	Spirit Lake	Joe Mucher's Chas. B. Moore 1, c s½ sw ne 14-16s-25w	10-14-48	4200	4120- 4127	Hill sd; L Cre	F 240; 11/64"	42
		CALIFORNIA—New Oil Pay						
Santa Barbara	Cat Canyon	General Pet Corp's Los Flores 86-21, Sect 21-9n-33w	10-17-48	5037	4676- 5037	Saxon sh	P 130	20.1
		CALIFORNIA—Oil Field Extensions						
Kern	Kern River, S.	Elmer C. Von Glahn's China 9, Sect 9-29s-28e So. extension	10-26-48	1240	1125- 1140	Sta. Margarita sd; Mio	P 30	12.8
Kern	Kern River, S.	Standard Oil Co's "KCL-26" 1-11, Sect 9-29s-28e, So. extension	10-29-48	1530	1430- 1527		P 6; 1 wtr	11.8
Monterey	San Ardo	Jergins & North American Cons. Oil Co's Orradre 197.11, Sect 11-25s-10e, So. extension.	10-30-48	2185	2085- 2185	Sta. Margarita sd; Mio	P 125	11.5
Santa Barbara	Russell Ranch	Richfield Oil Corp's Quality 88-31, Sect 31-11n-27w, SE extension	10-30-48	3360	3005- 3244	Miocene	Sw 800	....
		COLORADO—New Oil Field						
Archuleta		L. E. Teague et al's Fitzhugh 2, nw nw se 33-33n-1e, Chromo Area	10-28-48	555	535- 555	Mancos sd; U Cre	P 5	....
		COLORADO—Gas Field Extension						
La Plata	Barker Creek	Southern Union & Delhi Oil Co's Barker 2, sw nw 3-32n-14w, 2 mi n ext.	10-15-48	9560	8385- 9305	2nd Paradox sd; Penn	28.5 mln; open	....
		ILLINOIS—New Oil Fields						
Christian	Assumption	Nat'l. Assoc. Pet. Co's C. G. Sincox Tr. 1, ne nw ne 29-13n-1e, 15 mi fr prod.	10-12-48	3070	2325- 2356	Devonian li; Devo	P 31; 12 wtr	....
Franklin	Akin, w	B. Taylor & Schumaker's U. S. Coal & Coke 1, 250 fr sl 375 fr wl nw nw 21-6s-4e, 2½ mi w Akin pl.	10-26-48	3146	3050- 3060 3082- 3094	L O'Hara li; Miss Rosiclare li; Miss	P 80; 160 wtr	....
Gallatin	Shawneetown, N.	Johnston Drlg Co's G. E. Mathis 1, se ne nw 17-9s-10e, 2 mi ne Shawneetown pl.	10- 5-48	3091	3046- 3052	McClosky li; Miss	P 68; 25 wtr	....
		ILLINOIS—New Oil Pays						
Franklin	Thompsonville, N.	W. P. Ford's A. Wood Tr. 1, se sw 16-7s-4e, 1 mi sw prod.	10-31-48	2759	2750- 2757	Cypress sd; Miss	P 30; 30 wtr	....
Franklin	Whittington	George-Wrather & Aurora's N. Wilcox 1, se se sw 20-5s-3e, ½ mi s prod.	10-19-48	2318	2308- 2318	Hardinsburg sd; Miss	P 92	....
Wabash	Rochester	Lynch Oil & Alberding's L. W. Legier 1, se ne sw 14-2s-13w, ½ mi s prod.	10-12-48	1968	1221- 1298	Pennsylvanian sd; Penn	P 75	....
		ILLINOIS—Oil Field Extensions						
Clay	Bible Grove Consol.	Sohio's W. Stortzum et al 1, ne se ne 6-5n-7e, ½ mi extension	10- 5-48	2511	2491- 2508	Cypress sd; Miss	P 161; 130 wtr	....
Gallatin	Herald, E	Calvert & Willis & Ashland's Egli 1, w sw ne 30-7s-10e, 1½ mi se extension	10-26-48	2184	2171- 2180	Tar Springs sd; Miss	P 50	....
Richland	Dundas, E	W. Bell Est. et al's E. Phillips 1, ne sw sw 26-5n-10e, ¾ mi w extension	10-12-48	3007	2909- 2919	L O'Hara li; Miss	P 132	....
Richland	Amity	J. L. Black's Kocher 1, se nw sw 2-4n-14w, ½ mi ne extension	10- 5-48	2946	2931- 2936	McClosky li; Miss	P 37	....
Richland	Stringtown	P. Fulk et al's A. Jenkins 1, se nw se 30-5n-11e, 1 mi nw extension	10-26-48	3028	3016- 3026	McClosky li; Miss	P 1051	....
Wabash	Maud	Continental Oil Co's C. J. Schrodt 1, sw ne se 26-1s-13w, ¾ mi ne extension	10-19-48	2691	2680- 2687	Rosiclare li; Miss	P 11; 21 wtr	....
Wayne	Half Moon	Collins Bros' Messman 1, n nw nw 33-1s-9e, 1½ mi sw extension	10- 5-48	3405	3300- 3306	McClosky li; Miss	P 146	....
		INDIANA—New Oil Fields						
Gibson		George-Wrather L. O. Ziliak 1, ne ne se 18-4s-10w, 1½ mi se St. James pl.	10-14-48	2351	2259- 2264	L O'Hara li; Miss	Sw 30	....
Knox		S. D. Jarvis' L. J. Stilwell-Mary Holsen 1, Sect 13-1s-12w	10-28-48	2089	2075- 2089	Benoist sd; Miss	P 135	....
Posey		V. R. Gallagher, D. E. Schock-Aurora's John W. Spencer-Aletha Vogel 1, nw sw nw 12-8s-14w, 2 mi fr prod.	10-28-48	2971	2854- 2863	McClosky li; Miss	F 1178	....
Vanderburgh		George-Wrather's Wm. Reiman 1, sw se sw 30-4s-11w, n of Martin pl.	10-15-48	2631	2189- 2214	Cypress sd; Miss	P 275	....
Vigo		C. B. Mansfield's J. E. Sutliff 1, nw nw nw 14-11n-9w, 1 mi s Terre Haute, 7 mi fr prod.	10-19-48	1803	1672- 1702	Devonian li; Devo	F 840	43
		INDIANA—New Oil Pay						
Gibson	Ft Branch, W.	Flamingo Oils, Inc's John S. Teel 3, 330 fr n&wl nw sw nw 16-3s-11w	9-22-48	2274	2266- 2274	Bethel-Benoist sd; Miss	P 25	....
		INDIANA—Oil Field Extension						
Jay	Trenton	Stephen Jutte's Fee 2, nw sw sw 24-23n-15e	8-14-48	1144	1094- 1144	Trenton sd; Ord	P 11	....
		KANSAS—New Oil Fields						
Barton	Rolling Green	Cardinal Oil Co's Schartz 1, nw nw sw 36-20s-13w	10-19-48	3545	3257- 3263	Lansing-KC sd; Penn	P 137	....
Barton		J. M. Huber & Crowe Drlg Co's Soeken 1, sw ne nw 28-17s-11w, ¾ mi fr Kraft-Prusa pl.	10-28-48	3335	3286- 3298	Arbuckle li; Ord	P 10	....
Ellis		V. D. Sidney's Polifka 1, nw se se 7-13s-17w, 1¼ mi nw Sugar Loaf pl.	10-28-48	3691	3639- 3671	Arbuckle li; Ord	P 127	....
McPherson	Maxwell	Bay Pet Corp & Anderson-Prichard Oil Corp's State "B" 1, se se sw 17-18s-1w, 1½ mi se Burk pl.	10- 5-48	2871	2834- 2871	Mississippian sd; Miss	P 41	....
Nemaha	Strahm	Carter Oil Co's Mamie Strahm 1, sw sw nw 27-2s-14e, 16 mi sw Livengood pl.	10-12-48	2879	2847- 2879	Hunton li; Devo-Sil	P 50	23
Rooks	Gar-Rook	Nadel & Gussman's Baldwin 1, nw nw nw 30-9s-20w, 1 mi e Morel pl.	10-19-48	3872	3868- 3872	Arbuckle li; Ord	P 1226	....
Rooks	Marc	Derby Oil Co. & Aylward Drlg Co's Marcotte 1, se se sw 18-9s-19w, 1 mi n Gick pl.	10-28-48	3595	3358- 3362	Lansing-KC li; Penn	P 91	....
Stafford		B & R Drlg Co ; Delta Prod Co's Kelly 1, nw nw se 35-23s-12w, 2 mi n Stafford pl.	10- 5-48	3876	3872- 3875	Arbuckle li; Ord	P 84	....
		KANSAS—Oil Field Extension						
Rice	Wherry	Petroleum Inc. & Pabco Drlg Co's Engelland 1, sw sw ne 4-21s-7w, 1½ mi 1½ mi ne extension.	10-26-48	3356	3347- 3356	Conglomerate; Penn	P 50	....
		KANSAS—New Gas Fields						
Barber		Great Lakes Carbon Corp's Werner 1, sw se se 21-30s-14w, 3½ mi n Skinner, N., pl.	10-26-48	4610	4582- 4594	Simpson sd; Ord	4.5 mln	....
McPherson		George Hess's Bryan 1, nw nw se 23-19s-1w, 2 mi e Canton pl.	10-12-48	2927	2920- 2927	Mississippi sd; Miss	3.0 mln	....
		NORTH LOUISIANA—New Oil Fields						
Caddo	Fish Tail Lake	Michel T. Halbouty's Newton Smith 2, sw ne se 24-20n-15w, 3 mi w Dixie Twst.	10-19-47	3045	3035- 3038	Paluxy sd; L Cre	F 72; 8 wtr; 3/8"	30
Webster		E. V. Whitwell et al's C. B. Wise 1, c sw sw se 24-22n-10w, 4 mi n Cotton Valley fld.	10-10-48	2732	2694- 2696	Blossom sd; U Cre	P 25; 200 wtr	....

[1] Character of producing formations abbreviated thus: ch, chalk; dolo, dolomite; li, limestone; sd, sandstone; sh, shale; ser, serpentine; cgl, conglomerate. Ages of formations abbreviated thus: Plio, Pliocene; Mio, Miocene; Olig, Oligocene; Eoc, Eocene; U. Cre, Upper Cretaceous; L. Cre, Lower Cretaceous; Jur, Jurassic; Tri, Triassic; Perm, Permian; Penn, Pennsylvanian; U. Miss, Upper Mississippian; L. Miss, Lower Mississippian; Devo, Devonian; Sil, Silurian; Ord, Ordovician; Cam, Cambrian.

[2] Barrels of oil per day (24 hr. rate), flowing (F), pumping (P), swabbing (Sw), or bailing (B); or million cubic feet of gas daily open flow capacity; size of choke given in inches.

rope takes a beating like this, you ought to check the application"

"The foreman on this job was blowing his top. He was already behind in production when this machine went down. He swore that the wire lines were no good.

"We took a look at the sheaves. They were badly worn. Then I asked him, 'When did you check those grooves?' Nobody on the job could remember when the sheaves had been regrooved.

"We got out a gage. Sure enough, that's where the trouble was. The grooves had worn down so that the proper size gage nowhere near bottomed. Now they're regrooving and I sold him on the idea of letting me check all his equipment. I'll bet we keep his business and his lines will give twice the service."

Are you sure you have the RIGHT wire rope for your job!

Are you convinced beyond a doubt that your rotary lines are operating at the lowest obtainable unit cost?

Are you sure that your equipment is contributing fully to long, safe line life?

If not, you should have a check-up by a TIGER BRAND Specialist—a thoroughly experienced field service engineer.

To show you how the proper application of wire lines can save you money, we have prepared a new booklet to help you check your own operating conditions.

SEND FOR NEW FREE BOOKLET

American Steel & Wire Company
Rockefeller Building, Dept. Q-12
Cleveland 13, Ohio

Gentlemen:

Please send me a copy of your booklet, "Valuable Facts about the use and care of Wire Rope."

Name.....

Company.....

Position.....

Address.....

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

UNITED STATES STEEL

New Oil, Distillate and Gas Fields and New Pay Horizons Discovered in the United States in October, 1948—(Continued)

Also Important Extensions to Established Fields

COUNTY	FIELD	COMPANY, WELL AND LOCATION	Date Completed	Total Depth (Feet)	Completion Horizon (Feet)	[1]Name, Character and Age of Producing Formation	[2]Initial Production Method and Choke	Gravity of Oil
		NORTH LOUISIANA—New Distillate Field						
Lincoln	.....	Crescent Drlg Co's Mathews 1, 776 fr sl 660 fr el ne¼ 29-19n-2w, se flank Ruston fld.	10- 8-48	9390	8796- 8816	Cotton Valley sd; Jur	F 56; 1.6 mln; 3/32"	56
Ouachita	.....	California Co's Walter Maxey 2, 1643 fr nl 1647 fr el 32-18n-1e	10-21-48	9873	9580- 9873	Cotton Valley sd; Jur	F 22; 0.8 mln 5/8"	57
		NORTH LOUISIANA—New Distillate Pay						
Lincoln	Hico-Knowles	California Co's T. L. McCrary et al Unit B-31, Sect 14-19n-4w, ¾ mi sw disc.	10-10-48	9200	8912- 8924	Burgess-Simmons sd; Jur	F 592; 8.8 mln; ½"	....
		NORTH LOUISIANA—New Gas Field						
Ouachita	.....	California Co's Breece Lbr. et al 2, 1097 fr sl 1615 fr wl 30-17n-5e, 8 mi se Monroe.	10- 6-48	9454	5234- 5248	.....	2.3 mln; ⅜"	....
		SOUTH LOUISIANA—New Oil Pay						
St. Martin	Plumb Bob	Texas Co's St. Martin Ld. Co 21, 1202 n 2849 w fr sec Sect. 17-8s-7e	10- 9-48	11191	9964- 9978	.....	F 390; 5/32"	33
		SOUTH LOUISIANA—New Distillate Field						
Calcasieu	.....	Gulf Ref. Co's Krause & Managan Lbr. Co. 1-E, 330 fr s&el of n½ Sect. 17-9s-11w, 1¾ mi n Edgerly fld.	10-11-48	8863	8838- 8842	.....	F 54; 0.9 mln; ⅛"	41.6
Cameron	.....	Sohio Pet Co's S. W. Sweeney 1, Sect 22-15c-6w, 5 mi sw Lower Mud Lake	10-23-48	13067	8250- 8275	.....	no gge	....
		SOUTH LOUISIANA—New Distillate Pays						
Cameron	Pecan Lake	Superior Oil Co's Miami Corp B-5, 3069 s 1849 w of nec Sect 30-14s-3w	10-12-48	11804	10488-10505	.....	F 57; 3.5 mln; ¼"	47.6
Terrebone	Bay St. Elaine	Texas Co's State-Bay St. Elaine 1-C, Lse 1246, 1 mi e of prod.	10- 5-48	14137	13718-13740	.....	F 78; 2.9 mln; 5/16"	47.3
		SOUTH LOUISIANA—New Gas Field						
Terrebonne	.....	Union Prod Co's LaTerre-State Unit A-1, 1000 fr s&el Sect 42-19s-19e, 1 mi sw Bay Baptiste fld.	9-23-48	11997	10503-10511	.....	4.8 mln; ¼"	....
		MICHIGAN—New Oil Field						
Allegan	.....	Chester Anderson's Konecke 1, nw se sw 27-2n-13w, Allegan Twp	10-31-48	1361	1358- 1361	Traverse sd; Devo	P 8; 3 wtr	....
		MICHIGAN—New Oil Pay						
Mason	Eden	Superior Oil Co's Mabel L. Sippy et al 3, ne ne se 26-17n-16w	10- 8-48	2238	2235- 2238	Dundee li; Devo	F 1200; open	....
		MICHIGAN—Oil Field Extension						
Osceola	Reed City	Jetter & deKrafft's Bruske 1, sw nw se 26-18n-10w Lincoln Twp	10-31-48	3132	3111- 3132	Traverse sd; Devo	P 40	....
		MISSISSIPPI—Distillate Field Extension						
Marion	Sandy Hook	Humble O&R Co's G. F. & J. W. Hart Inc. 1, c se nw 22-1n-14e, 1 mi w ext.	10-20-48	9250	9014- 9020	L Tuscaloosa sd; U Cre	F 15; 1.1 mln; ⅛"	53
		MONTANA—New Oil Field						
Musselshell	.....	Amerada Pet Co's et al's Hougen 1, c se se 23-10n-29e, Melstone area	10-15-48	4229	4185- 4229	Kibbey sd; U Miss	F 655; ¾"	34.4
		NEW MEXICO—New Gas Field						
Eddy	.....	Harper Drlg Co's Spencer 1, nw sw sw 27-20s-23e, 2 mi sw Russell fld	10-15-48	846	760- 803	Yates sd; Perm	0.1 mln	....
		OKLAHOMA—New Oil Fields						
Creek	.....	Big Four Pet. Co's White 1, sw ne se 18-19n-8e, ¾ mi ne Cushing, E. fld.	10-14-48	2622	2588- 2622	Red Fork sd; Penn	F 40	38
Garvin	.....	Carter Oil Co's Pickett-Huffman 1, ne ne ne 23-2n-3w	10-31-48	7940	7776- 7814	4th Deese sd; Penn	F 166; ¼"	42.5
Garvin	.....	Magnolia Pet Co's Mason-Burns 1, nw se nw 34-4n-2w, 2 mi e Maysville, S. pl.	10-31-48	6280	6246- 6258	Bromide sd; Ord	F 419; ¼"	40
Garvin	.....	Sinclair-Prairie's Dolly Neill 1, c nw nw 15-4n-3w	10-28-48	7026	6832- 6852	Pennsylvanian sd; Penn	F 715; ¾"	41.2
Logan	.....	Mohawk Drlg Co's Marshall 1, se se se 14-17n-1e	11- 4-48	5160	3495- 3505	Skinner sd; Penn	F 16; 11/32"	39
Okfuskee	.....	Mid-Continent's Harman 1, nw se se 33-13n-10e, 1 mi se Haydenville, S. pl.	10-21-48	2972	2960- 2972	Gilcrease sd; Penn	F 121; ⅜"	38
Pawnee	.....	Mid-Continent's L. M. Robison 1, se se nw 1-20n-6e	10-28-48	3025	3003- 3024	Tucker sd; Penn	P 25	....
Payne	.....	Sun Oil Co's Linsenmeyer 1, ne ne nw 5-18n-4e	10-28-48	4283	3368- 3374	Peru (Wayside) sd; Penn	P 68	....
		OKLAHOMA—New Oil Pays						
Garvin	Panther Crk, SW.	Phillip Pet Co's Nesbitt 1, se se nw 34-3n-3w	10-28-48	8290	8134- 8150	Deese sd; Penn	F 265; 5/16"	41.8
Hughes	Jefferson, N.	Sherrod & Apperson's Barnard 7, se sw nw 24-8n-8e	10-21-48	3317	2810- 2830	Booch sd; Penn	P 21	38
McClain	Lindsay, NE.	Sinclair-Prairie's Etheridge 1, (OWDD), ne nw ne 25-5n-4w	10-14-48	10524	8086- 8114	Pennsylvania sd; Penn	F 100	43.3
		TEXAS—District 1 (SOUTH CENTRAL)—New Oil Field						
Dimitt	"Catarina"	Henderson Coquat & Algord Co's H. A. Dillion 2, 660 fr nw&swl of Lot 2, Blk 11, Taft Catarina Farms subd, 4 mi sw Catarina.	9-21-48	5210	4890- 4932	Navarro sd; U Cre	P 20; 4 wtr	42
		TEXAS—District 2 (MIDDLE GULF COAST)—New Oil Pays						
Goliad	Brant	Sunray Oil Corp's W. F. Albrecht 4, 330 fr wl 1532 fr nl of 303.35-ac lse, Thomas Hancock Sur.	10-16-48	7758	7736- 7743	Mackhank sd; Eoc	F 107; ¾"	33.3
Jackson	Francitas	McKay Donkin & Lloyd H. Smith's Lovett Est. 1, 2250 fr nw&swl Blk 18, Patrick Green Sur. ¾ mi ne prod.	10- 1-48	7953	7949- 7953	U. Kopnicky sd; Olig	F 120; ⅛"	41.4
		TEXAS—District 2 (MIDDLE GULF COAST)—Oil Field Extension						
Lavaca	Word	Moran Oil Co's Geo. Bujnoch 1, 330 fr el 425 fr sel of 120-ac lse, James Kerr Sur.	10- 3-48	8510	5867- 5871	Wilcox sd; Eoc	F 25; 5/32"	38.9
		TEXAS—District 2 (MIDDLE GULF COAST)—New Distillate Field						
Refugio	Blanco Creek	Southern Minerals Corp's W. S. Perryman 1, 467 fr s&el of 108.5-ac lse, J. de la Garza Trudo Sur. 5½ mi n Refugio	10- 1-48	7175	6630- 6635 7114- 7117	.....	F no gge; 27 mln; open F no gge; 9.3 mln; open	....
		TEXAS—District 2 (MIDDLE GULF COAST)—New Gas Field						
Victoria	.....	Jergins Oil Co's J. H. Fleming 1, 330 fr nw&swl of 539.5-ac lse, F. G. Hidalgo Gr. 1 mi s Coletto Creek fld.	9-19-48	5036	3264- 3266	.....	0.4 mln; ⅛"	....
		TEXAS—District 3 (UPPER GULF COAST)—New Oil Field						
Wharton	.....	Grossman & Hootkins' J. H. Long 1, c e½ of Blk 23, Lane City Twst. D. D. D. Baker Sur.	10-20-48	5610	5464- 5468	.....	F 114; ⅛"	27.4
		TEXAS—District 3 (UPPER GULF COAST)—New Oil Pays						
Brazoria	W. Columbia	Texas Co's W. H. Abrams 24 (OWWO), 25-ac Tr., M. C. Masterson Sur.	10-18-48	5622	5166- 5174	.....	F 50; 5/32"	28.6
Brazoria	W. Columbia (W. Fault Block)	Texas Co's W. H. Abrams 53, (OWWO, Geo. Tennile Sur.	10- 3-48	5883	5563- 5571	Marginulina sd; Olig	F 226; 5/32"	28.7
Colorado	Glasscock	Coast Co's C. G. Glasscock Unit 1, (OWWO), 640-ac lse, BBB&C Sur. 1 mi sw fr prod.	9-29-48	9580	9215- 9290	"T" sd; Eoc	F 75; 5/16"	44.7
Fort Bend	Blue Ridge	Swiss Oil Co's Davison 1-B, (OWWO), J. Pointevent Sur. 3, 220 fr nl 320 fr wl of 5-ac lse.	10- 9-48	4763	4438- 4448	.....	F 138; 3/64"	33.7
Harris	Pierce Junction, W. Flank	D. M. Wallace & John F. Merrick's C. S. Settegast et al 1, 1750 fr nl 330 fr wl Jos. Kapman Sur 44.	10-10-48	7243	7181- 7186	Vicksburg sd; Olig	F 72; ¼"	23
Madison	Day	Sun Oil Co's J. L. Cleere 1, 247.76-ac lse, John Crownover Sur.	10-12-48	2500	2371- 2372	.....	P 25; 18 wtr	22.8
Matagorda	Midfields, NW	Rowan Drlg Co & Texas Gulf Prod Co's Denman Kountze 1, 79.97-ac lse, Sect 18, Blk 8, I&GN Sur.	10- 1-48	6757	6242- 6244	.....	F 151; ⅛"	34.2
Matagorda	Sugar Valley	John S. Ivey & Morgan Oil Co's Octave Herman 4, 200-ac lse, Burnett & Sojourner Sur.	10- 4-48	10251	9754- 9759	.....	F 130; 5/32"	29.6
		TEXAS—District 3 (UPPER GULF COAST)—Oil Field Extensions						
Matagorda	Midfields	Sun Oil Co's St. Louis Brownsville Corp 1, 200-ac lse, I&GN Sur No. 2, 330 fr n & 2850 fr el of Sur. ⅜ mi sw extension.	10- 8-48	9175	9126- 9130	Frio sd; Olig	F 37; ⅛"	45
Orange	Port Neches,	Shell Oil Co Inc's Southern Pet. Co 2, 726.15-ac lse, Susan Frazier Sur ¾ mi se extension.	10-23-48	8668	8604- 8610	.....	F 191; ⅛"	38.7
		TEXAS—District 3 (UPPER GULF COAST)—Distillate Field Extension						
Brazoria	Chocolate Bayou	Phillips Pet. Co's Houston H-1, Blk 23, E. Andrews Sur. 1 mi s extension.	10- 2-48	11706	11024-11054	Frio sd; Olig	F 293; 4.6 mln; ¼"	46.1
		TEXAS—District 3 (UPPER GULF COAST)—New Gas Pays						
Hardin	Beach Creek	American Republics & Houston Oil Co's H&TC Fee 3, (OWWO), 7423-ac lse, Tr. 2, H&TC Sur.	10-31-48	7555	6458- 6465	Eocene	3.2 mln; ¼"	35.7

[1] Character of producing formations abbreviated thus: ch, chalk; dolo, dolomite; li, limestone; sd, sandstone; sh, shale; ser, serpentine; cgl, conglomerate. Ages of formations abbreviated thus: Plio, Pliocene; Mio, Miocene; Olig, Oligocene; Eoc, Eocene; U. Cre, Upper Cretaceous; L. Cre, Lower Cretaceous; Jur, Jurassic; Tri, Triassic; Perm, Permian; Penn, Pennsylvanian; U. Miss, Upper Mississippian; L. Miss, Lower Mississippian; Devo, Devonian; Sil, Silurian; Ord, Ordovician; Cam, Cambrian.

[2] Barrels of oil per day (24 hr. rate), flowing (F), pumping (P), swabbing (Sw), or bailing (B); or million cubic feet of gas daily open flow capacity; size of choke given in inches.

There's a Maloney-Crawford Treater Type to *Economically and Efficiently* HANDLE EVERY EMULSION PROBLEM

Maloney-Crawford specialized treaters are the answer to handling varied emulsion problems. The Maloney-Crawford design provides for a long, slow wash which results in lower furnace temperatures, less shrinkage loss, and lower fuel cost. No excelsior is required and, where needed, economy in chemicals is assured.

A Maloney-Crawford treater assures economical trouble-free operation on the tightest emulsions.

TYPE L

A treater designed for the treating of loose type emulsions, replacing the heater and gunbarrel hook-up normally used. Considerable savings effected in pipe costs and hook-up time, as the unit is self-contained. May be operated up to 4 lbs. pressure.

TYPE M-H

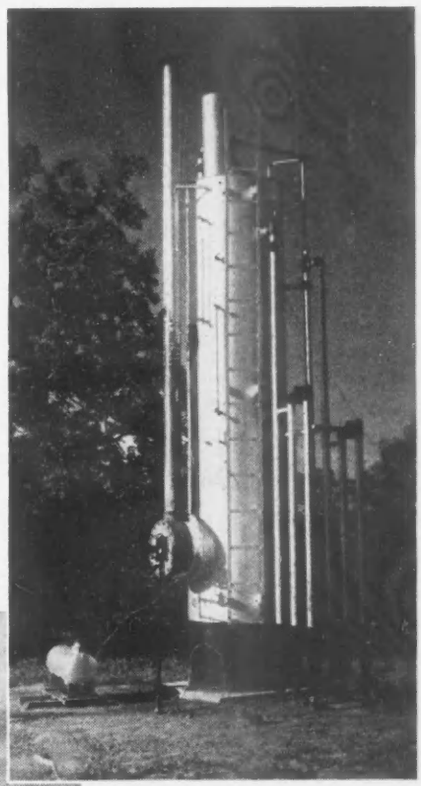
A horizontal treater offering many advantages over vertical type. No upending is necessary. Heat exchanger and syphon box factory installed providing savings in hook-up and installation costs. Skid-mounted and fully portable. Operate at pressures up to 25 lbs.

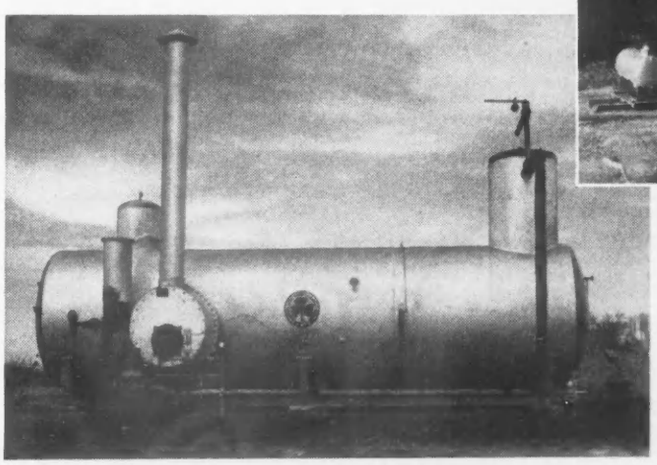
TYPE D

A treater with long-travel wash tray unit giving the water wash and retention of heat necessary to break the tightest emulsion. So built as to conserve gravity of treated oil and reduce demand on the furnace. May be operated at atmospheric pressure and up to 25 lbs.

TYPE Y

A treater constructed with same furnace, long-travel trays and other features of Type D, except working pressure. Due to the utilization of a flat bottom and coned deck, this treater has a maximum working pressure of 4 lbs.





Above: Maloney-Crawford Vertical Type L-4 Treater near Yale, Okla.

Left: Maloney-Crawford Horizontal Type M-6-H Treater near Corpus Christi.

STOCKS AND SERVICE

Artesia, New Mexico; Tulsa and Oklahoma City, Oklahoma; Corpus Christi, Dallas, Fort Worth, Odessa, Pampa, Houston and Wichita Falls, Texas; New Orleans and Lafayette, Louisiana; Calgary, Edminton and Lloyd Minister, Canada.

MALONEY CRAWFORD

MALONEY-CRAWFORD TANK & MFG. CO.

Box 659 **Tulsa, Oklahoma**

Export Representative: Baird Lines, 420 Lexington Avenue, New York, N. Y.
Canadian Representative: Dominion Oil Field Supply Co., Ltd., Calgary

New Oil, Distillate and Gas Fields and New Pay Horizons Discovered in the United States in October, 1948—(Continued)

Also Important Extensions to Established Fields

COUNTY	FIELD	COMPANY, WELL AND LOCATION	Date Completed	Total Depth (Feet)	Completion Horizon (Feet)	[1]Name, Character and Age of Producing Formation	[2]Initial Production Method and Choke	Gravity of Oil
Harris	Durkee	Houston Oil Co's George Hofer et al Unit 1, Blk 6, George Green Sur.	10-12-48	8110	7177- 7183		12 mln; open	
Wharton	Egypt-Deep	Claud B. Hamill's F. B. & Donald Duncan 2, 3000-ac lse, Alexander Edgar Lge.	10-13-48	7809	7160- 7164		5.0 mln; open	
		TEXAS—District 4 (LOWER GULF-SW.)—New Oil Fields						
Duval	"Vaello"	Hiawatha O&G Co's Frank Vaello, Jr. 2, 190-ac lse, San Andres Gr. 500 fr wl 1100 fr sl of lse, 4 mi se Benavides.	10-4 -48	5691	4860- 4865		F 86; 5/32"	43.9
San Patricio		J. W. Mayo et al's Blaschke & Mayo 1, 467 fr s&el of sw¼ of Sect 67, George H. Paul's subd of Coleman-Fulton Pastr. Co Lds. 1¼ mi sw Midway fld.	10-30-48	7016	5288- 5290 6591- 6599	Frio sd; Olig Frio sd; Olig	F 96; 1/8" gas (no gge)	32
Starr		Rowan & Hope's Bentsen Bros 1, 467 fr n&el CCSD&RGNG Sur 549, 7 mi ne Rincon fld.	10-13-48	7003	5330- 5335 6954- 6956		no gge F 149; 1/8"	 40.8
Starr	"Borosa"	Sunray Oil Corp's Davenport-State 1, 330 fr nl 2242 fr el CCSD&RGNG Sur. 1¾ mi e Rincon fld.	10- 3-48	6002	4297- 4303	"C" (Frio) sd; Olig	F 144; 5/32"	47.6
		TEXAS—District 4 (LOWER GULF-SW.)—New Oil Pays						
Jim Wells	Haldeman, S.	Sunray Oil Corp's C. T. Hewitt D-7, Sect 51, R P. Haldeman Subd of Seeligson Rch.	10-28-48	5601	5466- 5478	Zone 21-D sd; Olig	F 138; 7/64"	41.9
Nueces	Farenthold	Rand Morgan's Fee A-10, lot 5, Richard King Farm lots, Casa Blanca Sur.	10- 2-48	6473	6062- 6066		F 61; 15 wtr; 1/8"	43.4
		TEXAS—District 4 (LOWER GULF-SW.)—Oil Field Extensions						
Aranasas	Fulton Beach	Placid Oil Co's Spencer-Kent-Crane Unit 1, 330 fr sw&nel 79.39-ac lse, C. O. D. Gilliland Sur, ⅝ mi n extension	10-20-48	7181	7142- 7146	Frio sd; Olig	F 110; 11/64"	42.6
Duval	Cadena	Taylor Ref Co's Flores 1, 330 fr nel 2000 fr nwl Sur 28, ½ mi sw extension	9-16-48	6200	5568- 5576	Yegua sd; Eoc	F 34; 7/64"	41
		TEXAS—District 4 (LOWER GULF-SW.)—New Distillate Fields						
Duval		Atlantic Ref Co's Hagist Ranch 1, 660 fr sl 1980 fr wl BS&F Sur. 267, 1¼ mi ne Eagle Hill fld	10- 5-48	10081	7044- 7208	Wilcox sd; Eoc	F 59; 2.5 mln; ¼"	56.7
Jim Wells	"Palito Blanco"	Texas Co's Zella C. Foster 1, 350 fr wl 330 fr sl of Tr 3 Swanson Yarbrow Sur. 5 mi w-sw Ben Bolt fld	10- 1-48	7800	4460- 4470		F 169; 11.8 mln; open	
		TEXAS—District 4 (LOWER GULF-SW.)—New Distillate Pay						
Nueces	Minnie Bcck, N.	Atlantic Ref Co's Bickler & Mosely 1, s½ of Sect 53, Geo. H. Paul Sbdn. Joaquin Lopez de Herrera Sur.	10-20-48	8504	7958- 7988		F (no gge); 9.5 mln; open	
		TEXAS—District 6 (NORTHEAST)—New Oil Field						
Smith		Delta Drlg Co's Max Rice 1 660 fr s'y sl 2150 fr s'ly el of Oliver Anderson Sur. 3½ mi sw Tyler.	10- 6-48	7891	7572- 7608	Paluxy sd; L Cre	P 89	26.5
		TEXAS—District 6 (NORTHEAST)—New Oil Pay						
Anderson	Blackfoot	Texas Co's Dock Hanks 1, 660 fr sl 1000 fr el Wm. Allbright Sur. 3250 ft ne extension.	9- 3-48	10080	9960-10000	Travis Peak sd; L Cre	P 63	44.3
		TEXAS—District 7-B (NORTH CENTRAL)—New Oil Fields						
Brown		J. A. Chapman Prod Co's M. J. Ballard 1, 330 fr n&wl Blk 18, J. Dickinson Sur. 2½ mi ne May.	10-16-48	3070	3026- 3050	Marble Falls li; Penn	F 244; ¼"	39
Comanche		Haynes B. Ownby Drlg Co's Robert A. Lindley 1, 330 fr nl 990 fr wl of ne¼ Sect 52, H&TC Sur. 1 mi s Kirk fld.	10-31-48	2901	2840- 2901	Bend li; Penn	F 15; 15 wtr; ¼"	39.8
Comanche		Haynes B. Ownby Drlg Co's W. F. Flatt 1, 330 fr sl 990 fr wl Sect 39, Blk 2, H&TC Sur, 5 mi nw Deleon.	10- 8-48	2890	2787- 2818	Marble Falls li; Penn	F 41; ½"	38
Comanche		Star Oil Co's J. B. Anderson 1, 330 fr n&el D&DA Sur. 4½ mi sw Gorman	10-24-48	2850	2546- 2550	Caddo li; Penn	P 40	40
Jones	"West Anson"	Humble O&R Co's J. K. Pittard 1, 467 fr e&sl of ne¼ Sect 4, Blk 1, T&NORR Sur, 1½ mi w Anson.	10- 1-48	4425	4310- 4340	Canyon sd; Penn	P 52; 15 wtr	41.3
Jones		Ralph Stewart's W. D. Minter 1, 330 fr n&wl Sect 41, Blk 15, T&PRR Sur. 3 mi n Hawley.	10- 5-48	2036	2032- 2036		P 96	38
Taylor		Sojourner Drlg Co's D. O. Huddleston 1, 330 fr nl 1820 fr wl Lot 4, Lge 147, Grimes CSL Sur. 2 mi s Merkel.	10-20-48	2841	2783- 2787		F 168; ¼"	40
Throckmorton		M. W. Grisham's W. A. Morrison 1, 1922 fr nl 330 fr el Sect 1193, TE&L Sur. 9 mi sw Throckmorton.	10-29-48	3933	3919- 3927		F 56; ¼"	40
Throckmorton		Warren Oil Corp's J. T. Davis 1, 1862 fr nl 2630 fr el Sect 163, BBB&CRR Sur. 8 mi sw Throckmorton.	10-24-48	5229	4716- 4740	Caddo li; Penn	P 66	43
		TEXAS—District 7-B (NORTH CENTRAL)—Oil Field Extension						
Wise	Chico	Standard Fryer Drlg Co. et al's R. L. Morris 1, 330 fr n&el W. Bohn Sur. ¾ mi sw extension.	10-26-48	5247	5191- 5205	Bend cgl; Penn	F 118	41
		TEXAS—District 7-C (WEST CENTRAL)—New Oil Fields						
Upton		Republic Natural Gas Co's Rosa Halff Barnett 1-A, 1980 fr n&wl Sect 40, Blk Y, TC RR Sur, 2¾ mi nw Benedum pl.	10- 6-48	12036	11242-11310	Fusselman sd; Sil	F 457; 51 wtr ½"	58.7
Cochran		Anderson-Pritchard Oil Corp's Ford Hawkins 1, 440 fr s&el Tr. 17, Lge. 131, Carson CSL, 12 mi sw Morton.	10-13-48	4980	4838- 4953		F 40; 1"	29
		TEXAS—District 8 (WEST)—New Oil Fields						
Hockley		Woodley Pet Co's J. J. Alderson et al 1. 660 fr n&wl Sect 10, Blk A, R. M. Thompson Sur., 3 mi ne Smyer.	10-16-48	5979	5825- 5844	Glorietta li; Perm	F 157; 2½"	26
Mitchell		Kingery Bros & South Texas Dev Co's Merritt & Pond 1, 2310 fr nl 330 fr el Sect 27, Blk 29, T-1-N, T&P Sur, 3 mi n Iatan N. pl.	10-15-48	2829	2461- 2721		P 22	28
		TEXAS—District 8 (WEST)—Oil Field Extensions						
Andrews	Shafter Lake	Cities Service Oil Co's University 1-Y, Sect 13, Blk 13, Univ Lds Sur. 1¾ mi n extension.	10- 6-48	9950	8508- 8545 9660- 9959	Wolfcamp li; Perm Devonian sd; Devo	F 2115; ¾" F 1833; ¾"	42.8 38.3
Crane	Crossett-3200'	Texas Co's Cordova Union 2-G, 660 fr ne&sel Sect 31, Blk 35, H&TC Sur. 1¼ mi w extension.	10- 1-48	5590	3310- 3355	Holt li; Perm	F 188; 11/64"	45.8
Gaines	Seminole, W.	Cities Service & Atlantic Ref Co's Proctor 2, Sect 355, Blk G, CCSD&RGNG Sur. 1 mi e extension.	10- 1-48	7660	5038- 5179	San Andres li; Perm	F 473; 7/16"	30.7
		TEXAS—District 9 (NORTH)—New Oil Fields						
Archer		Fain & McGaha's W. L. King 1, 990 fr el 1474 fr sl Wm. Henry Sur, 2 mi 2 mi e Archer City.	10-19-48	3780	3752- 3780	Strawn sd; Penn	P 80; 50 wtr	41
Archer		Stewart & Grisham's Belle Wisdcme Est 2, 750 s 150 w of sec Blk 123, ATNCL Sur., but in Jose Ustane Sur. 2 mi n Archer City.	10- 3-48	1175	1168- 1175		P 55	38.7
Archer		T. F. Hunter's T. B. Wilson 1, 3830 fr el 3225 fr sl S. P. Ellis Sur., Sect 2, 2¾ mi se Mankins fld.	10- 5-48	5036	4988- 5036	Mississippi li; Miss	F 204; 125 wtr; 3/4"	43
Wichita		Consolidated Oil Co et al's Jno H. Norwood et al 1, 1263 fr w&wl Blk 36, Palo Pinto CSL, 3 mi s Iowa Park.	10-23-48	4150	4118- 4150	Lwr KMA sd; Penn	F 816; ¾"	42
		TEXAS—District 9 (NORTH)—New Oil Pay						
Wichita	Lake Wichita Caddo	Consolidated Oil Co's Sisk Est 1, 330 fr nl 990 fr wl Blk 23, Lge 2, Denton CSL 7 mi sw Wichita Falls.	10-28-48	5362	5336- 5354	Bend cgl; Penn	P 30	42
		TEXAS—District 9 (NORTH)—Oil Field Extensions						
Archer	Archer Co. Reg.	Cochran & Cain's Burt Lowery 1-B, Blk 55, Harris Subd of Club Ranch, ½ mi extension.	10-30-48	1169	1164- 1169	Cisco sd; Penn	P 95	
Clay	Joy-Strawn	L. T. Burn's J. Gilbert 2, (OWDD), 330 fr nl 167 fr wl, C. Thompson Sur. ¾ mi se extension.	10-31-48	4451	4439- 4451	Strawn sd; Penn	F 103; 5/32"	42
Cooke	Woodbine	Harvey Drlg. Co. et al's E. R. Haynes 1, H. Baker Sur 5000-ft ne extension.	10-17-48	4815	4282- 4293	Strawn sd; Penn	P 42	26.5
		WYOMING—New Oil Fields						
Weston	Fiddler Creek	Clark Drlg Co. et al's Whitzel 1, nw ne sw 19-46n-64w, 15 mi nw Mush Creek fld.	10-19-48	4552	4502- 4552	Newcastle (Muddy) sd; U Cre	F 649; ¾"	48
Weston	Mush Creek, W.	Sierra Pet Co's Kummerle 1, ne ne se 14-45n-65w.	10-15-48	5447	5380- 5381	Dakota sd; U Cre	P 60; 190 wtr	
		WYOMING—New Oil Pay						
Big Horn	Allen Lake, E.	Wasatch Oil Co's Hintze-Gov't 1, (OWDD), c ne se 18-22n-78w.	10-10-48	3964	3920- 3945	Tensleep sd; Penn	P 36	24
		WYOMING—New Gas Field						
Park	Heart Mountain	Trigood Oil Co's Taggert 1, nw sw sw 8-54n-102w.	10-30-48	4001	1974- 2041	3rd Frontier sd; U Cre	6 mln	

[1] Character of producing formations abbreviated thus: ch, chalk; dolo, dolomite; li, limestone; sd, sandstone; sh, shale; ser, serpentine; cgl, conglomerate. Ages of formations abbreviated thus: Plio, Pliocene; Mio, Miocene; Olig, Oligocene; Eoc, Eocene; U. Cre, Upper Cretaceous; L. Cre, Lower Cretaceous; Jur, Jurassic; Tri, Triassic; Perm, Permian; Penn, Pennsylvanian; U. Miss, Upper Mississippian; L. Miss, Lower Mississippian; Devo, Devonian; Sil, Silurian; Ord, Ordovician; Cam, Cambrian.

[2] Barrels of oil per day (24 hr. rate), flowing (F), pumping (P), swabbing (Sw), or bailing (B); or million cubic feet of gas daily open flow capacity; size of choke given in inches.

Good Engineering Practice Drives

DEEP BRISCOE WELL

By JOHN T. BEDFORD
Petroleum Engineer

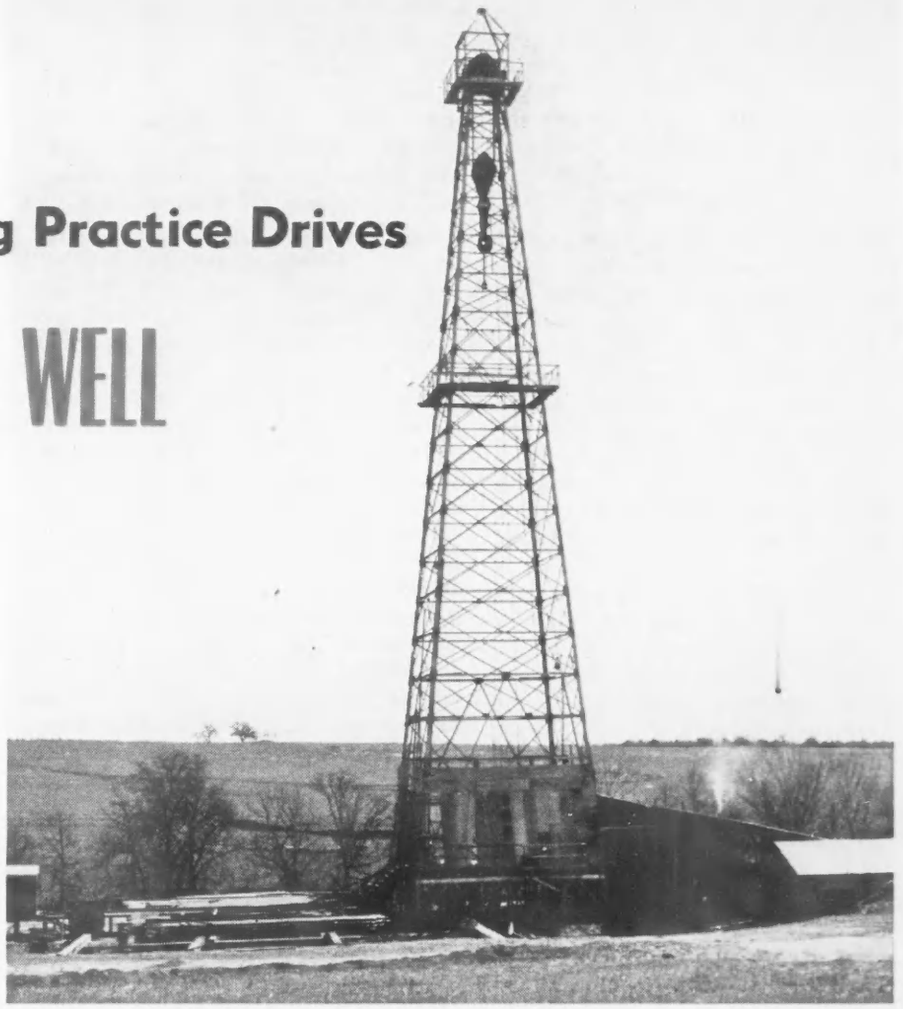


FIGURE 1.—An early picture of the Briscoe Unit 1, a wildcat drilled to 15,184 feet without any major trouble.

WHILE Stanolind Oil and Gas Company officials claim no records as to production depths in connection with the successful completion of the Briscoe Unit 1, located south of Brady in Grady County, Oklahoma, petroleum engineers are giving close study to the company's drilling program and technique since this hole was carried to a total depth of 15,184 feet—nearly three miles—without serious mishap or fishing jobs. In the annals of deep drilling, engineers consider this an important achievement and believe that the methods employed by Stanolind will have a profound bearing on future deep drilling where trouble-free hole means the difference between success or failure from the standpoint of economy.

The Briscoe Unit 1 wildcat was drilled in the center of the NW SE of Sec. 4-4n-5w, at the south end of the Anadarko Basin, which includes the Cement and Apache fields and whose southern rim is formed by the Wichita Mountains in some of the toughest formations of the entire Mid-Continent area. Kerr-McGee Oil Industries, Inc., of Oklahoma City, were the contractors.

HIGHLIGHTS ON the successful completion of an Oklahoma well to 15,184 feet without mechanical failure or tubular goods fishing job demonstrate the possibility of reaching depths well below average with present equipment when the men are carefully chosen and the job is carefully engineered throughout.

The well was drilled to 12,662 feet with conventional rotary tools and diamond-core drilled from that depth to 15,184 feet with the hole bottomed 87 feet in Arbuckle limestone topped at 15,097 feet. Producing sands are the Bromide and Upper McLish found between 13,673 and 14,192 feet. Drilling began October 7, 1946, and the hole was finaled March 31, 1948, when the test showed a straw-colored oil testing 48.1° which flowed at the rate of 68.12 barrels in five hours through 2½-inch tubing plugged on bottom and perforated between 14,164-167 feet, producing through ¾-inch coke. Packer was set in the seven-inch oil string at 13,359 feet and the well kicked off on swabbing to 5200 feet. Initial gas/oil ratio was 2850/1, bottom hole pressure was 5800 pounds per square inch, and bottom hole temperature was 209°F.

Besides opening a major oil pool in the Anadarko Basin, the Briscoe Unit well established a unique record in that company engineers, employing well established drilling procedures, were able to carry the hole to completion without time lost for breakdowns or major fishing jobs. The only fishing was two basket-bit runs at separate trips, each

picking up a cone. To drill a 15,000-foot hole in that area of the Anadarko Basin without serious trouble and in some of the toughest and most treacherous digging in the world required the best in men, methods, and equipment.

Selection of Workers

Stanolind picked its drillers and crews with care and although heavy equipment of proved design was used and most up-to-date methods employed, much of the credit for the feat was due to the improvisation of new methods and techniques in the field and in head offices of the drilling department. Analysis of drilling procedures clearly shows that the men in charge followed the principle of anticipating trouble before it happened and removing or mitigating its causes.

Classified as advanced techniques were selection of and constant application of the sclerograph, a device for testing the strength of tubular steel which was used to examine all drill stem and the use of diamond-core drilling in the deeper formations.

Since the operator is limited in the number of casing strings that he can run, considerable care was exercised in avoiding open-hole trouble caused by formation sloughing. In this connection important facts were deduced as to the behavior of mud-weighted fluids at increasing depths.

At the Briscoe the danger of wearing through the top joint of casing by the square kelly was mitigated by the use of rubber protectors on the drill pipe. This helped in keeping the pipe straight and resulted in a more vertical hole.

The sclerograph, used for the first time in the field at the Briscoe Unit well, is a high-precision instrument involving ultrasonic principles which are applicable in analyzing drill pipe and other tubular equipment for tensile strength, detection of fractures and slag inclusions, and determination of effects of stresses and strains on the drill pipe. Interpretation is by photographic record. The instrument was designed by Donald R. Lloyd, engineer with Mud Control Laboratories, Oklahoma City. Based fundamentally on Barkhausen's discovery of ferromagnetization, the sclerograph operates on the principle that when a piece of metal is magnetized and at the same time subjected to its natural resonate frequency, the elementary magnetic groups will lock into position and remain so until again disturbed. The intensity and length of each magnetic group is controlled by the actual crystalline structure of the material under consideration.

The sclerograph is entirely portable and may be set up in less than 20 minutes. A joint of drill pipe is completely analyzed in about ten minutes, including the photographic record which may be filed. In the case of a joint of drill pipe, if the section is not homogeneous throughout the entire cross section and contains a variation of the structure such as might result from a fracture or fatigue, the magnetic group at that particular section of the drill pipe will also vary and will be indicated on the photographic plate.

Purpose of Sclerograph

It is generally recognized that certain grades of drill pipe may be usable in a given area under drilling conditions peculiar to that area, but the use of the same drill pipe might prove highly hazardous under a different set of conditions. The purpose of the sclerograph is to determine the condition of the pipe so that the operator may make up a string which will minimize the risk of pipe failure.

Stanolind used a rig which proved adequate in design and strength for the drilling of the Briscoe Unit 1. The rig was originally set up for 10,000 feet. Below this depth, periodic safety checks revealed that using heavier elevators, installing a double rotor brake, reducing pump liners from five to 4¾ inches, and increasing the number of lines from eight to ten, provided the additional margins of safety required to carry the hole deeper. The rig performed satisfactorily throughout the 541 operating days, making more than 200 trips in the long 6719-foot section of the open hole.

SUMMARY OF RIG TIME EXPENDITURE
Sept. 23, 1946 - March 31, 1948

333 days	Conventional drilling
165 days	Diamond-core drilling
15 days	Testing
14 days	Laying lines and rigging up
7 days	Total on casing strings
7 days	Waiting on and drilling cement
3 days	Changing drilling strings
10 days	Conditioning hole and running logs
2 days	Motor maintenance and repair

Three motors with a combined horsepower of 1086 were operated at 69 percent over-all efficiency for pumping and hoisting. A 36-inch low speed clutch rated at 70,000 foot pounds torque capacity was able to take any loads deliverable within safe limits of a 1½-inch drilling line. Maximum indicated torque during one trip was 33.9 percent of the rated capacity of the low speed clutch. The hook load rating for the drawworks using ten lines in low speed was 478,700 pounds.

Caliper log run in open hole between 7100 feet and the seven inch casing

FIGURE 2.—Head tool pusher Art Medis, who spent many watchful hours on this job.

point at 13,737 feet indicates that the long open hole section was practically without deviation from vertical; in itself a remarkable accomplishment. It is common knowledge that in the Golden Trend area (local designation for the area in which the Briscoe Unit 1 was drilled) excessive weight on the bit and irregular rotation invariably cause the hole to deviate from vertical. Factors contributing to the smooth wall were proper tension in drill pipe, use of proper mud mixture, and true rig alignment. At the Briscoe, drill collar selection and running received special attention. Twenty-four hour mud watches were maintained and a water-base mud was used throughout.

Special Problems

The drilling of this deep test constantly presented special problems which challenged the experience, efficiency and ingenuity of all connected with the operation. Because of past successful experience with diamond-core drilling in hard formations Stanolind decided to employ this technique for the last 1552 feet of hole.

A core barrel of 5 9/16-inch outside diameter with a 5⅞-inch outside diameter bit, cutting a 3¾-inch core was first used. This allowed only five-sixteenths of an inch clearance between the outer tube and the hard formation. The risk of sticking the core barrel presented the need for a greater annular clearance plus the necessity of providing space for overshot or tapping in the event of a fish. In order to meet this hazard a new size core barrel with a 4½-inch diameter was designed, thus adding a half inch to the annular clearance. The bottom sub-section of this core barrel was heavily reinforced with N-80 grade steel which was specially processed for strength. Design changes to afford greater safety were made in the drill collar connection, bearing assembly, and inner barrel (Figure 3). The regulation API threads were reduced to one thread per inch. This enabled disengagement by backing off, coming out of the hole with the drill collar connection, bearing assembly and inner barrel intact. Upon return the inside diameter of the outer tube was

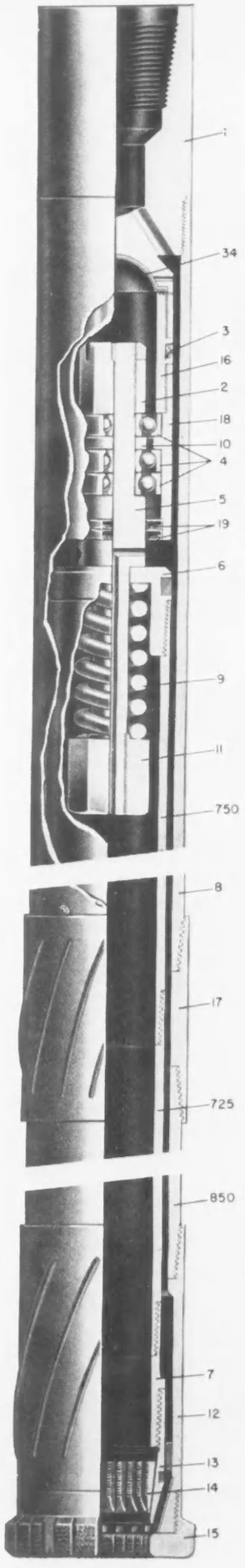


FIGURE 3.—The core barrel which was redesigned to meet the drilling problems on the Briscoe. The length of the top drill collar connection was increased and below the API thread a one-thread-per-inch male was installed with the female being cut on the heavy outer tube. The tubular strength was increased by a special heating and chemical process.

open for tapping. This device was engineered as a precautionary measure but was never used. No drilling time was lost in the change-over to diamond-core drilling.

Rig time relative to diamond-core drilling was saved by installation of a smaller circulating pump and this reduction in the rate of well fluid passing underneath the bit allowed the diamond bit to rest on the formation with the required weight of 4000 pounds. Despite the reduction in pump size fluid delivered was ample to cool the diamonds and the matrix. Unlike a rock bit which chips and fractures the formation, a diamond bit grinds itself ahead and the most effective footage was obtained by the following setup. Pump pressure was maintained between 800 and 850 pounds per square inch, circulating a mud weighing ten pounds per gallon with a Marsh funnel velocity of 120 seconds on a quart out at a rate of 40 gallons per minute. The table was turned an average of 60 revolutions per minute and the drill penetrated approximately one foot per 25 minutes.

Diamond core drilling at the Briscoe Unit test, as well as in other tests observed in other sections of the country, indicates that its economic use depends on the formation and the core recovery desired. The longer a diamond bit is run the more expensive is the exchange cost due to loss and excessive wear on the diamonds peculiar to each formation. Diamond bits used at the Briscoe well exchanged for about $750 after cutting from 28 to 56 feet of core. (On one run a total of 150 feet was recovered). The over-all cost of diamond-core drilling was approximately $100 per foot in the Bromide formation. This apparent high cost, however, was balanced by the fact that a round trip with rock bit cost about $600 and the bit cut only 18 inches of hole at 14,500 feet.

Seating the Bit

The most important phase of diamond-core drilling is the technique of properly seating the bit in the hole. Pieces of junk steel in the hole should be cleaned out and it is necessary to run a junk basket to recover lost rock bit cones, etc. Mud of proper weight and viscosity is then circulated at high pressure about one foot off bottom to further clean the hole. Pumps are then set to their required number of strokes, which is found by an immediate check of the mud flowing from the well and not from pump calculations. The volume of mud required for effective penetration depends on the bit size, the outside diameter of the core barrel, plus a circulation sufficient to cool the dia-

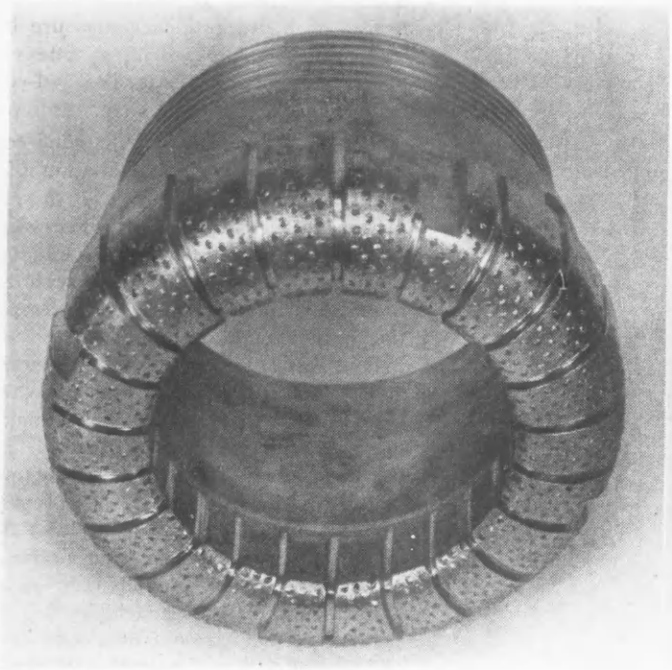


FIGURE 4.—The "R" type diamond bit used on the Briscoe.

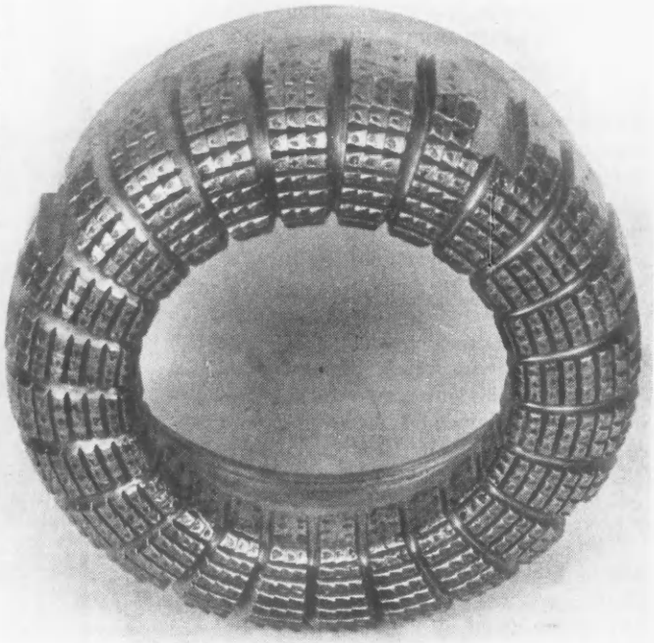


FIGURE 5.—The "WR" type bit used on the Briscoe.

monds and yet not too great to force a hydraulic action between the bit and the bottom of the hole.

As soon as the required volume of well fluid is circulating the bit is rotated slowly and eased to bottom. It is important that the bit be gently braked to bottom due to tendency of diamonds to fracture and shear if subjected to excessive weight instantaneously. With the bit on bottom, pump pressure is increased about 100 pounds and the rotary table is speeded up to about 65 revolutions per minute. With the bit now seating around the core, approximately 1000 pounds of weight is constantly applied to the bit. A ribbed hard metal stabilizer of the same outside diameter as the bit follows directly behind it and insures the bearing surface required to keep the hole vertical. As soon as the bottom stabilizer of the core barrel is seated the most efficient drilling rate is established by a weight variation of 3000 to 6000 pounds steady feed on the bit. This is held until 28 or 50 feet of core is cut, depending on the length of the barrel used.

The rig on the Briscoe had a new fluid stabilizer on the weight indicator and the weight readings were taken as accurate, within limits, but drillers usually make allowances for the fluid-working-against-the-diaphragm types of indicators. In West Texas where a temperature change of 60°F. takes place during a 24-hour period the driller is forced to estimate by experience the variations caused by the indicator fluid as it expands and contracts.

Since there is a limited supply of various sized flawless diamonds and those which are marketed must be adapted to the industry's need, the diamond-core bit is a scientific adjustment to the need of the hour. The matrix which is built to support the commercial diamonds must also allow free passage of the well fluid. Matrix failures were common when diamond-core drilling was first introduced but metallurgists now have compounded setting alloys which have eliminated this cause of failure. Figures 4 and 5 show the "R" and "WR" type of bits used at the Briscoe Unit 1. In the "R" bit the diamonds are set vertically and in the "WR" bit the cutting edge of the diamond is at an angle of from five to 30 degrees with the edge of the face of the particle against which it is grinding. Too large a fluid course would reduce the effective ratio of the area of the diamond cutting faces to the total grinding area of the bit. Bit cost is held to a minimum and the rate of penetration to a maximum by keeping the ratio of the outside diameter of the bit to the core size as small as possible.

Stanolind's achievement in successfully carrying a wildcat to a total depth of 15,184 feet without a major mishap or fishing job is due to the excellent 'round-the-clock supervision and cooperation of all companies involved in the operation. Special credit must go to key personnel who planned and completed this well including C. D. Kerr, district superintendent, and George H. Galloway, district geologist for Stanolind; T. M. Kerr, vice-president, Kerr-McGee Oil Industries, Inc (contractors), and T. L. Glover, in charge of Mid-Continent operations, with Otis Danielson and B. D. McCampbell, engineers; Art Medis, G. E. Skaggs and T. G. Maxwell, tool pushers; R. J. Carlson, manager, Bob Johnson, field supervisor, W. J. Rogers and Frank Bell, engineers, all with Mud Control Laboratories. Drillers and crew members deserve full credit for their fine teamwork.

General Well Data

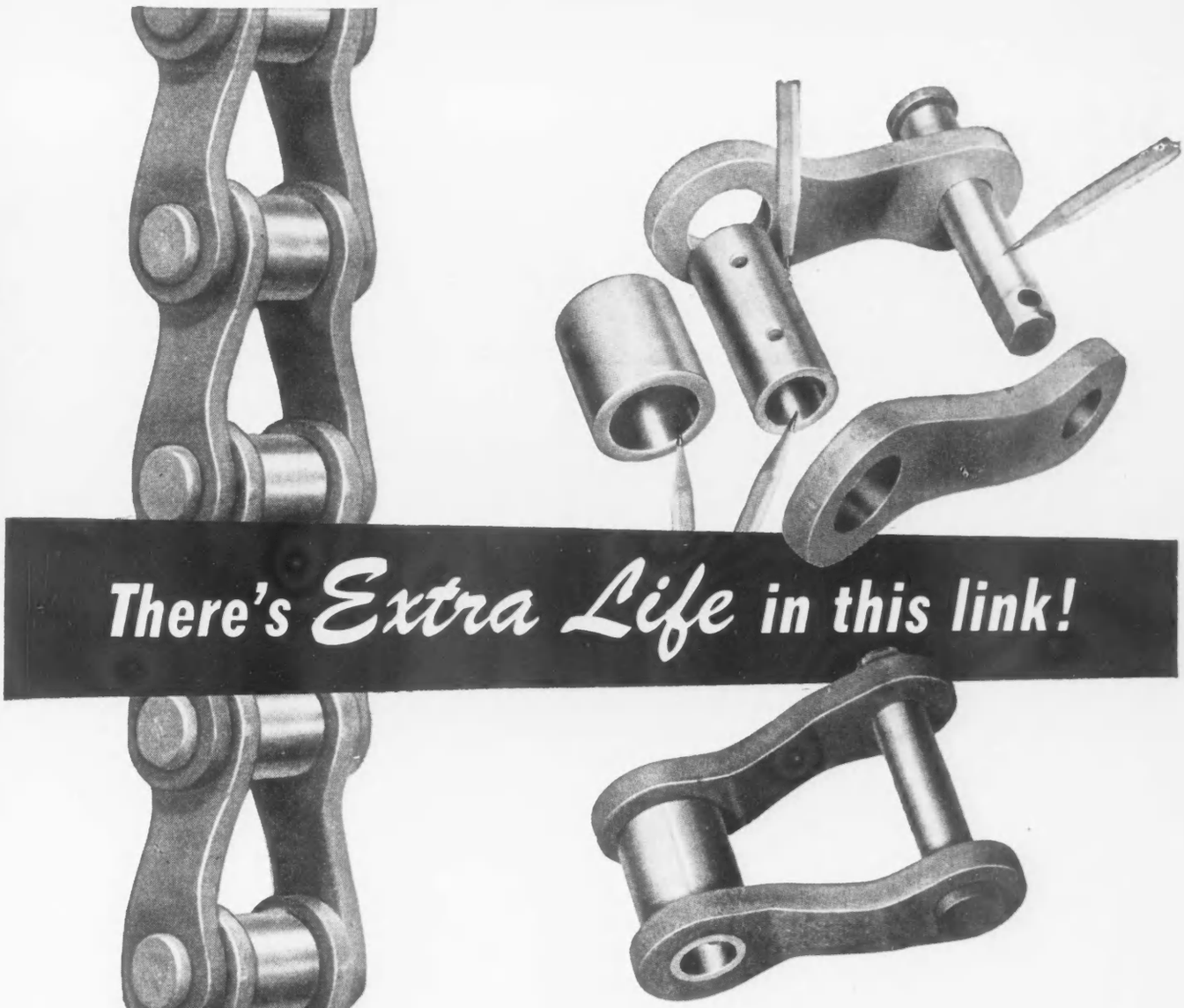
Casing Program:
521 feet 13⅜-inch O.D. set with 500 sacks Portland cement.
6959 feet (47# N-80) 9⅝-inch O.D. set with 500 sacks Portland cement.
13,670 feet 7-inch O.D. set with 470 pounds slow-set cement.

The 7-inch combination string:
Top — Max. Tension 26#/ft. N-80
Middle— 23#/ft. N-80
Bottom—Max. Collapse 32#/ft. N-80

Bits Used:
180 Rock Bits (Av. 35 feet)
9 Cutter Heads
30 Diamond bits

Equipment Changes after 10,000 feet:
Changeover from 8 to 10 line
Changeover from 4½-inch to 3½-inch drill pipe
Changeover from 3½ to 13.3 pound pipe
Pump liners reduced to 4¾-inch I.D.
Double Rotor Brake installed

Equipment	Rated Capacity	% of Rated Capacity Required by Load
Derrick 136'x30'	800,000#	35%
Drilling Line-1¼" IPS IWPC	140,000# Break	30%
Crownblock	660,000#	43%
Traveling Block	600,000#	39%
Hook	600,000#	40%
Swivel (R3)	400,000# (Unit Rating)	54%
Elevator Bails	600,000#	40%
Elevators	300,000#	72%
Low Friction Drum Clutch	70,000#	34%



There's *Extra Life* in this link!

HERE'S the secret behind the ability of the Rex Unit Link to keep its pitch under the toughest operating condition . . . to last longer . . . to deliver lowest cost per foot of hole drilled.

Note the side bars as shown in the photo above. Holes are machine finished for extra accuracy . . . free from any sharp corners to start cracking and quick loosening of the pin. Pins and bushings are carefully heat treated and ground to close tolerances for the precise fit that assures maximum strength and service life.

And when these precision parts are put together by the accurately controlled presses that assure heavy force fits at every desired point, you can be sure that the Rex Unit Link is put together to stay . . . will not develop the sloppy fits that cause premature wear on sprockets and chain.

Your Rex Field Engineer or your local supply store will be glad to show you how you can get lower chain cost per foot of hole drilled with Rex Chabelco Oil Field Chains, or, if you prefer, write direct to Chain Belt Company, 1639 West Bruce Street, Milwaukee 4, Wis.

CHAIN BELT REX COMPANY

REX OIL FIELD CHAINS

the chains that have grown up with the oil fields

Sidewall Sampling . . . Tools and Techniques

Part 2—CONCLUSION

By J. E. KASTROP
Staff Writer

ILLUSTRATED in Figure 6 is a modern percussion sidewall sampler capable of taking from one to 18 individual well samples during one run of the tool into the hole. A standard core taker of this type contains 18 shots which may be fired individually at any desired depth. It is lowered in the open hole on multiconductor electrical cable on which is mounted an electrode immediately above the sampler for indicating potential measurements (self potential log) during the coring operation. Function of these simultaneous potential measurements is to exactly position the gun in relation to selected index peaks on the conventional electrical log of the well. This method of locating the gun in the well eliminates any discrepancies that may exist between electrical log depth and sidewall sampler depth and insures taking a formation sample exactly where desired. The same surface equipment and cable are used to run the electrodes when making an electrical survey as those used to run the sidewall sampler. Depth adjustments can be made accurately by correlating the self potential curve on the electrical log with potential measurements made while running the sidewall sampler.

The sample taker consists of a housing or "block" containing six bullets or core tubes as shown in Figure 7. The lower bullet in this block is extended to illustrate what takes place when the bullet is fired. Each block is mounted in a carrier body which is 4¼ inches in diameter and tubular in construction. They are screwed and locked in position in the carrier.

A recess immediately below each block provides space into which the extended bullets may be housed in the event the gun is pulled through a tight section or bridge in the hole. Each barrel or core tube is cylindrical in shape, cuts a ¾-inch diameter core and is 1¾ inches in length. Two retrieving wires are attached to "ears" near the muzzle of each barrel. Holes bored into the base of the barrel provide passage of fluid during flight of the bullet. A grooved cap containing a ring gasket is screwed into the base of each bullet, making a pressure-tight seal when loaded. The barrel fits tightly into a cannon which is loaded with approximately 2.7 grams of explosives. Igniting wires in each cannon differ slightly in electrical resistance, and all six igniting wires in each block are connected in series. An insulated conductor connects each block with a surface source of direct current power. The mud column acts as a common ground for the return circuit in each block.

Detonating each bullet is accomplished by passing sufficient current through the igniting wires to set off the charge of explosives. Resistance of the igniting wire in the lowest cannon is higher than the resistance of the remaining wires, and therefore, less current is required to ignite the lower charge. The lower bullet is fired by passing about one-fourth ampere through the igniting wire (for the 18-shot gun), while the top bullet in each block is detonated by passing about two amperes through the igniting wire.

In practice, an electrical log is made first and coring points selected. The logging electrodes are removed from the hole and disconnected from the cable. A sidewall sampler gun is screwed in its place and lowered to bottom. The operator carefully checks depth readings by comparing prominent points on the electrical log (which he keeps in front of him) with potential measurements indicated on a shaded screen. After the lowest coring point has been exactly located, the lower bullet in the lower block is fired. A pair of earphones connected into the igniting circuit make it possible to hear the break in the igniting wire when the bullet detonates, thereby providing an audible check at the surface of subsurface operations.

After the lower block of bullets has been expended, the operator switches to the circuit connecting the adjacent block, and the operation is repeated. Amount of tension in the cable is indicated by electric meters (these are actually ohmmeters measuring the change in resistance of a strain gage) in the control cab. Observation of the tension meters reveal to the operator when the core tube has been pulled from the formation, for there will be a sudden drop in cable tension back to normal load. Tensile strength of each retrieving wire is approximately 1100 pounds. If the core tube should become firmly lodged in a formation, these wires can be pulled apart with no damage to the hole. When all cores have been taken, the gun is slowly withdrawn from the well. Each core tube or barrel is disconnected from the gun by cutting both retrieving wires. A mandrel and punch block are used to remove the cores from the barrel. Each core is then placed in a closed bottle and labelled.

Rotary Type Coring Tools

While the idea of boring a formation sample from the wall of a well bore is not recent, practical equipment which would successfully perform this operation did not appear until recently. Applications for patents on this method of coring were made as early as 1928. Since that time, engineering research and development have combined with the ma-

chinist's skill to produce the refined rotary sidewall coring equipment available today.

Designed for taking samples in extremely hard formation is an electrically-driven rotary sidewall sampler measuring ten feet three inches in length and five inches in outside diameter (Figures 9 and 10). Weighing 290 pounds, the mechanical core taker is lowered into the well on multi-conductor electrical cable which is also used in making electrical surveys. Power is furnished by a direct-current electric motor which transmits rotation through a series of shafts and universal joints to the core barrel assembly.

Particularly adapted for uses in limestone and hard sandstone areas, this relatively new mechanical core taker employs commercial diamonds which are fused into the core cutter head. Operation of the sampler is fully controlled from the surface. The tool is located at the desired depth where a core is to be taken by comparing the self potential curve on the conventional electrical log with potential measurements made while running the sampler. The same type cable is used to run the electrically-driven sampler as that used to run the percussion sampler previously described. Method of positioning both samplers in the well is also identical.

Designed to take nine cores during one trip in the hole, the mechanical core taker contains a core barrel which itself will hold four cores. Each core, averaging about two inches in length and ¾-inch in diameter, is stored in a core tube located inside the tool immediately below the core head window in the sampler body. Cores are separated automatically by steel balls which are dropped on top of each core as it is placed in the core tube. If a core is missed, two steel balls will be found together; otherwise, they will appear between core samples.

A retractable backup arm controlled by operation of the core barrel assembly positions the core cutting head as near the wall of the hole as possible. Operation of the sampler is relatively simple, and recoveries have been in the order of six out of eight attempts.

Utilizing both hydraulic and mechanical principles is a sidewall coring tool which depends upon drill pipe rotation to cut a formation core. This rotary side wall sampler (Figure 11) consists of a core barrel housing, a core barrel, a dummy barrel, and a fishing tool assembly equipped with automatic jars. The core barrel is run in the hole through a specially-designed circulating head which permits rotation of the drill pipe and circulation of drilling fluid before, during, and after the core has been cut. The integral parts of this tool are mounted on a steel skid for ease of handling between jobs.

The core barrel housing, which is run in the hole on bottom of the drill pipe, contains a driver spline, rubber seal or core barrel packoff, swivel, and whipstock. A rib or shoe bolted to the lower part of the housing places the whipstock port near the wall face and acts as a wedge to prevent the lower housing assembly from turning while the upper section is rotated. The core barrel embodies a driver, a safety valve housing, a barrel sub, a lower barrel spacer, two universal joints, a coring collar and a core cutter head. The safety valve housing is a tubular section containing two sets of circulating ports spaced a sufficient distance apart to accommodate a safety valve between them.

After the housing assembly has been lowered into the hole approximately 200

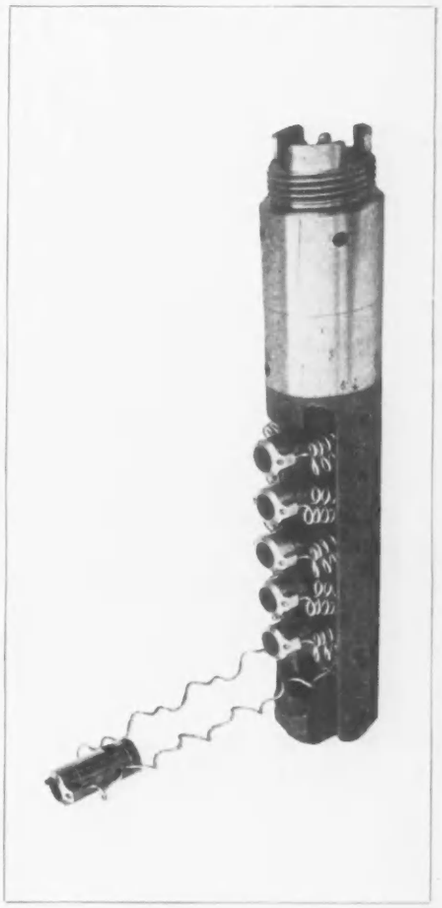


FIGURE 6 (Left).—Eighteen-shot percussion type sidewall sampler. This tool is screwed into a connector head attached to multi-conductor electrical cable for lowering into the well.

FIGURE 7 (Above).—Individual block containing six core tubes with the lower tube extended. Three of these blocks make up the standard 18-shot percussion gun.

FIGURE 8.—Removing 18-shot percussion sampler from a 5300-foot Gulf Coast well. Mud from the wall of the hole has covered the expended bullets.

feet, the dummy barrel is dropped in the drill pipe. It falls into place in the housing and comes to rest on a tapered shoulder in the swivel. The housing is then lowered to a depth below the lowest coring point. Nozzle of the dummy barrel is aimed at the deflecting plate which is jetted clean when circulation is resumed. When the mud is conditioned, the overshot or fishing tool assembly retrieves the dummy barrel, during which time the drill pipe may be rotated. The whipstock face is then accurately located at the lowest coring point.

The circulating head is kept as near the drilling floor as possible through the use of "pup" joints, or extra-short joints of drill pipe. With the pipe suspended in the slips, the core barrel is dropped into the hole. Circulation of mud under a few hundred pounds pressure is resumed in order to pump the barrel down. When the core barrel enters the housing assembly, flow is restricted, thereby causing the mud pressure suddenly to increase. The drill pipe is then rotated and mud pump pressure up to about 500 pounds is applied to force the core head into the formation. Mud passes down the drill pipe, through the lower set of ports in the barrel, down the tubular section into the hose threaded through two universal joints, around the inner barrel, and out through ports in the core cutter head. Torque is transmitted from the drill pipe to the core barrel by the driver spline and driver dog.

When the barrel has traveled its full length into the formation, the lower circulation ports pass below the rubber seal, thereby providing additional passage of fluid and causing a sudden drop in pressure plus an increase in fluid flow. If, for any reason, more fluid is required, mud pressure in the order of 1000 psi will shear the pin retaining the safety valve packing element and additional ports will be opened to mud flow.

With the core barrel fully extended

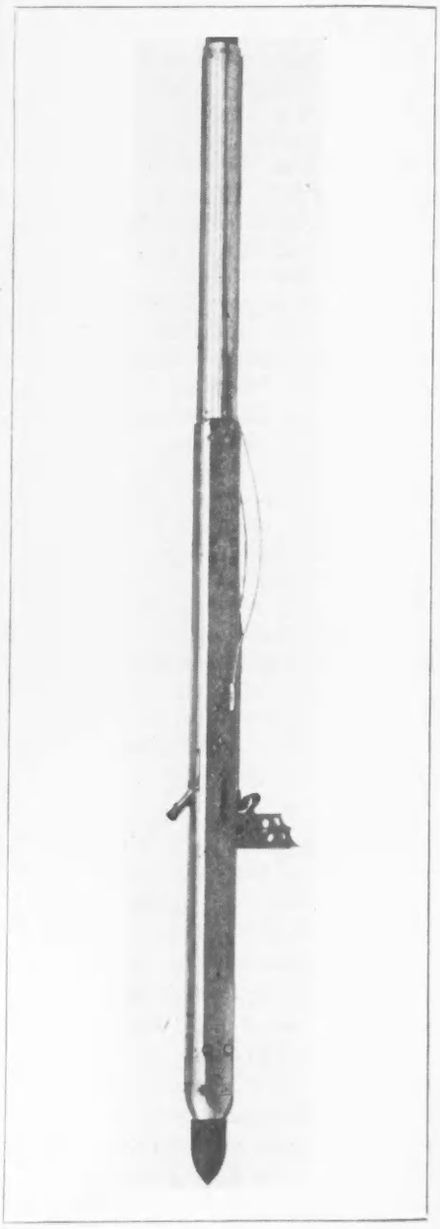
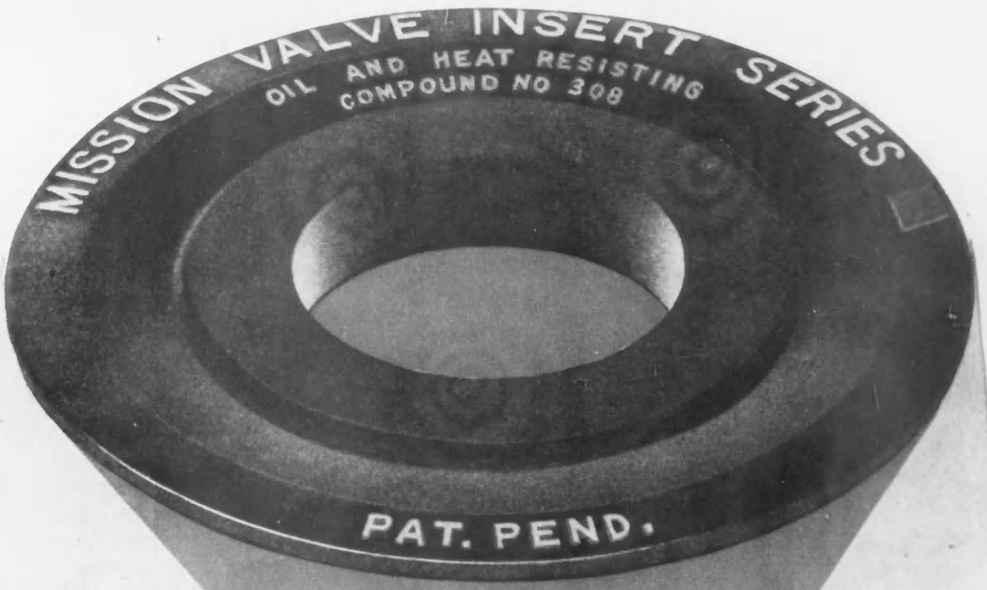


FIGURE 9.—Electrically-driven rotary sidewall sampler showing coring tube and backup arm fully extended. This particular sampler is lowered into the hole on multi-conductor electrical cable.

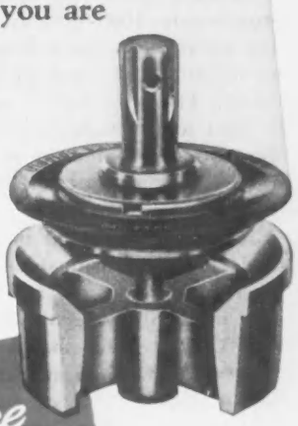


This insert on either valve means better slush pump service!

The Mission Compound-308* Valve Insert lasts longer under all conditions. As a result valve failures are minimized and your slush pumps work more efficiently for longer periods of time.

This insert is used on either of Mission's two great valves. Choose the valve best suited to your operating conditions and use it with confidence, for you are assured of getting the best valve service available.

MISSION *Slush Pump* VALVES



MISSION *Silver Top* SLUSH PUMP VALVE

. . . features a replaceable, wear-taking bushing that makes it the most economical valve on the market *for general service.*

MISSION *Super Service* SLUSH PUMP VALVE

. . . is especially designed *for use where pressures are extremely high.*

Sold through supply stores everywhere.

B-114

*Trade Mark Reg. U. S. Patent Office

MISSION MANUFACTURING CO.

P. O. BOX 4209 HOUSTON 14, TEXAS

Export Office: 30 Rockefeller Plaza, New York 20, N. Y. European Address: London, England.

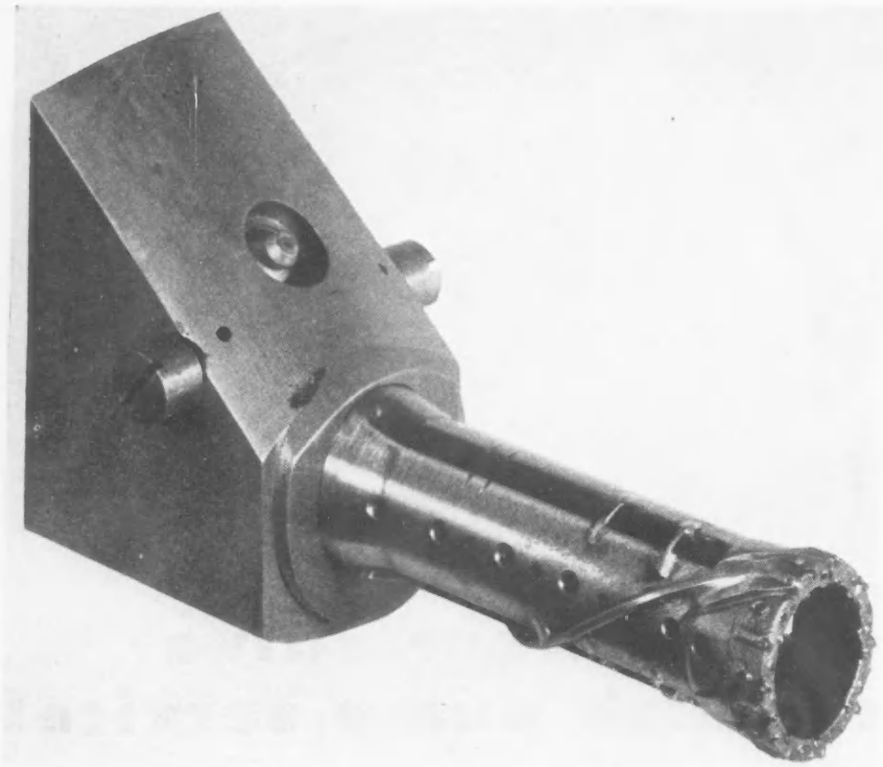


FIGURE 10.—Closeup of rotary core tube. Note fused diamonds in cutter head. Length of the core barrel is sufficient to store four average-sized cores, each about two inches long.

as indicated by mud pump pressure, the fishing tool assembly is again run to bottom and the core barrel recovered. Important feature of the fishing assembly is the automatic jars. After the fish is engaged in the overshot, a pull of approximately 1000 pounds on the sand line will release the spring-loaded automatic jars, which unload in an upward thrust. The core barrel is jarred from its seat and withdrawn from the pipe. The core barrel housing is raised to the next coring point and the procedure repeated.

Safety features built into the tool include a hinged whipstock face held in place by a hinge pin and shear pin. If it is impossible to pull the core barrel with the wire line, the overshot can be released and removed from the hole. The drill pipe is raised, causing the deflector plate to bear against the coring collar. The shear pin is severed and the deflector plate swings down exposing a "U" shaped retriever slot. This slot engages a shoulder on the coring collar, and the core barrel recovered by pulling the drill pipe out of the hole.

Optimum Conditions

The perfect core, if there be such, is one which is brought to the surface in sufficient volume for completing laboratory analysis and one which exists under the same physical conditions as it did in the virgin formation. Several attempts have been made to obtain such a core, but to date, most methods have proven impractical for wide application.

Cores can be taken in ample quantity for complete examination and with a minimum contamination. Meticulous investigation of modern core samples is hampered by drilling fluid contamination and by the fact that surface temperatures and pressures to which the core is exposed differ considerably from subsurface conditions. If sidewall samples are taken from the well as soon as practicable after a new section of the hole is drilled, minimum drilling fluid contamination will result. Another equally important advantage in sidewall coring a hole that has not been key seated or washed out is the increased efficiency of sidewall sampling tools. Enlarged holes appreciably affect the recovery and operation of some tools.

Sidewall coring tools herein described are not intended to completely replace conventional coring methods. They are designed as a necessary complement, to be used where conventional coring cannot be accomplished or where drilling practices are such that contract depth is reached without taking conventional cores. Sidewall sampling is fast and provides the desired information in most cases. Great strides have been made in sidewall coring tools and techniques, and it is not surprising that additional developments and applications are continually being made of this important oil field tool.

FIGURE 11.—Mechanical type rotary sidewall coring tool shown in cross section. Core cutter head is powered by rotating drill pipe. Hydraulic pressure forces core barrel into formation.

BIBLIOGRAPHY

Sneigr, Denis S., "Bullets Now Take Side Wall Cores," The Oil Weekly, Vol. 91, p. 46, Sept. 26, 1938.

"The Place of Mechanical Sidewall Coring," The Oil Weekly, Vol. 119, No. 2, p. 54, Sept. 10, 1945.

Yancy, J. R., "Developments in Side Wall Coring by the Rotary Method," 1946 Conference on Petroleum Mechanical Engineering, Tulsa.

Leonardon, Eugene G., and McCann, D. C., "Exploring Drill Holes by Sample-Taking Bullets," Petr. Dev. and Tech. AIME, Vol. 132, p. 85, 1939.

"Side-Wall Sampling," API, Finding and Producing Oil, p. 131, 1939.

Flood, H. Lee, "Side-Wall Coring in the Gulf Coast Area," Pet. Engr. p. 156, March, 1941.

Mechanics of Drill-Stem Testing

Part 1

By ROY E. EDWARDS
Engineer, Mechanical Research & Development
Halliburton Oil Well Cementing Company

USE OF THE DRILL stem as a means for testing conditions down the hole involves many factors which must be evaluated if the testing is to prove satisfactory and give a true picture of conditions. The author discusses various types of equipment and their handling under unfavorable conditions of well bore and presents examples developing the hydrostatic requirements of packers and other equipment.

MOST operators and engineers engaged in the drilling and development phase of oil well operations are familiar with the technique of drill stem testing; however, many are not familiar with the mechanics of drill stem testing. It is the purpose of this article to set forth these basic principles in the belief that a knowledge of the manner in which they apply will improve the technique.

In drill stem testing, as in most problems of hydrostatics, atmospheric pressure usually has access to the mass of liquid under consideration. The relative variations of barometric pressure and atmospheric temperature as they affect measurements in drill stem testing measurements can generally be regarded as insignificant.

The units of pressure are expressed in the familiar terms of pounds per square inch, feet of fluid, and, for gas measurement, inches of water or inches of mercury. It is a familiar fundamental fact that the pressure exerted by a column of fluid can be expressed as the product of the specific gravity of the fluid and the pressure exerted by an equal column of water.

Other fundamentals that apply are:

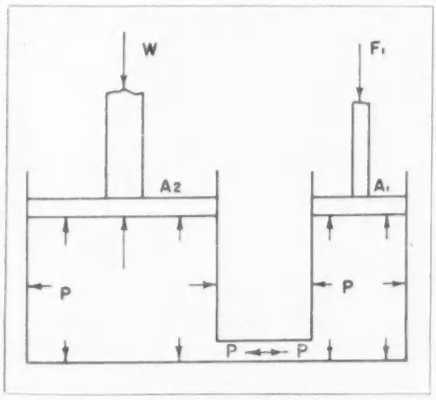
1. Pressure is the force per unit of area, and the total force on an area is the product of the pressure and the total area.

2. Fluid pressure is transmitted undiminished in all directions at a given point.

3. A body partly or wholly submerged in a fluid experiences an upward force equal to the weight of the displaced fluid.

It can be noted that the force required to thrust an empty vessel in an upright position into a tub of water increases as the vessel is thrust deeper into the liquid. It is the difference of the weight of the testing "string" minus this buoyant force that appears on the weight indicator of the drilling rig when running the testing assembly into the well.

Figure 1 illustrates a simple application of fundamental No. 2 and it can be seen that Figure 2 is a rearrangement of Figure 1. Carrying these principles a step further, Figure 3 shows their application to a universally used testing tool. By adding the products of the pressures and the areas on which they act and taking into consideration the direction of action, the net effective force on the tool can be determined. Pressure (P_2) is atmospheric or some pressure less than (P_f), the fluid pressure in the well bore. If any external forces other than pressure (pipe weight, for example) are applied, their magnitude and direction should be taken into consideration to determine the net effective force on the tool. The effects of pressure must be converted to total force before adding to the forces caused by other factors.



Force Multiplication
FIGURE 1

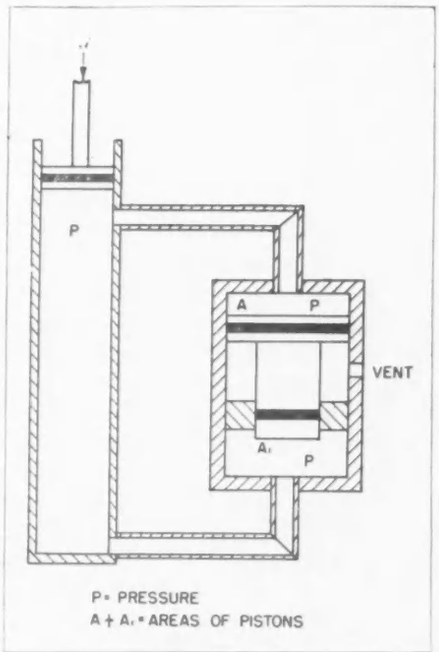


FIGURE 2

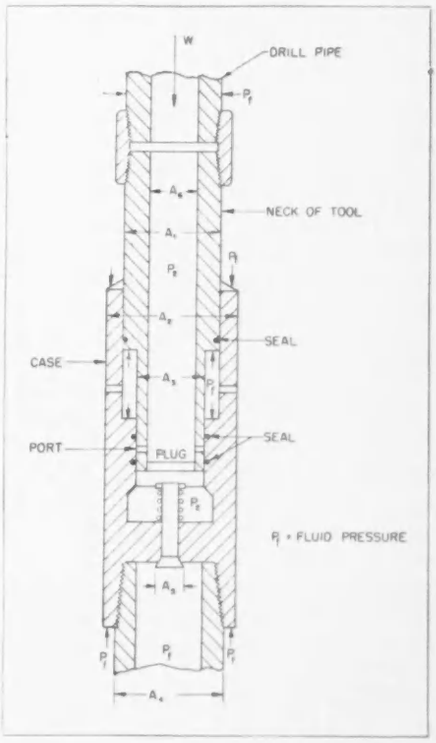


FIGURE 3

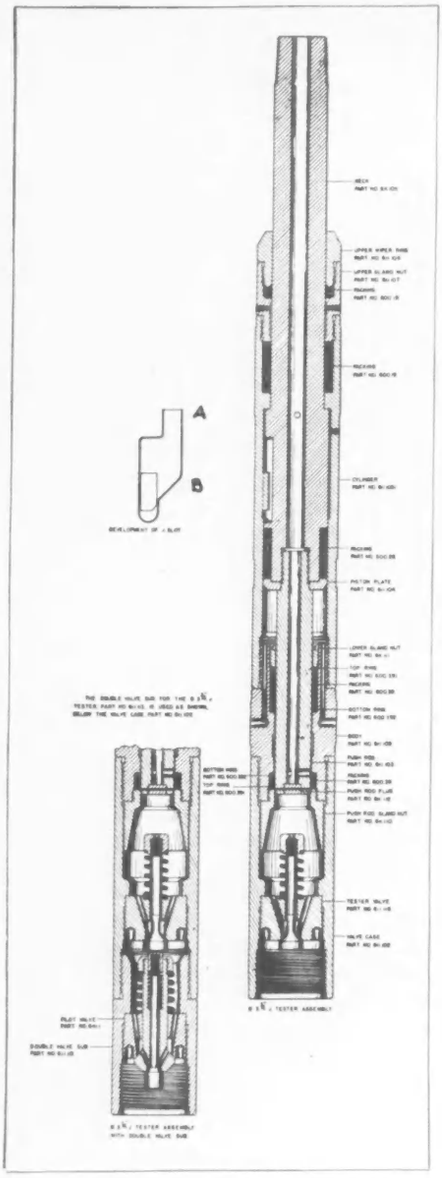


FIGURE 4

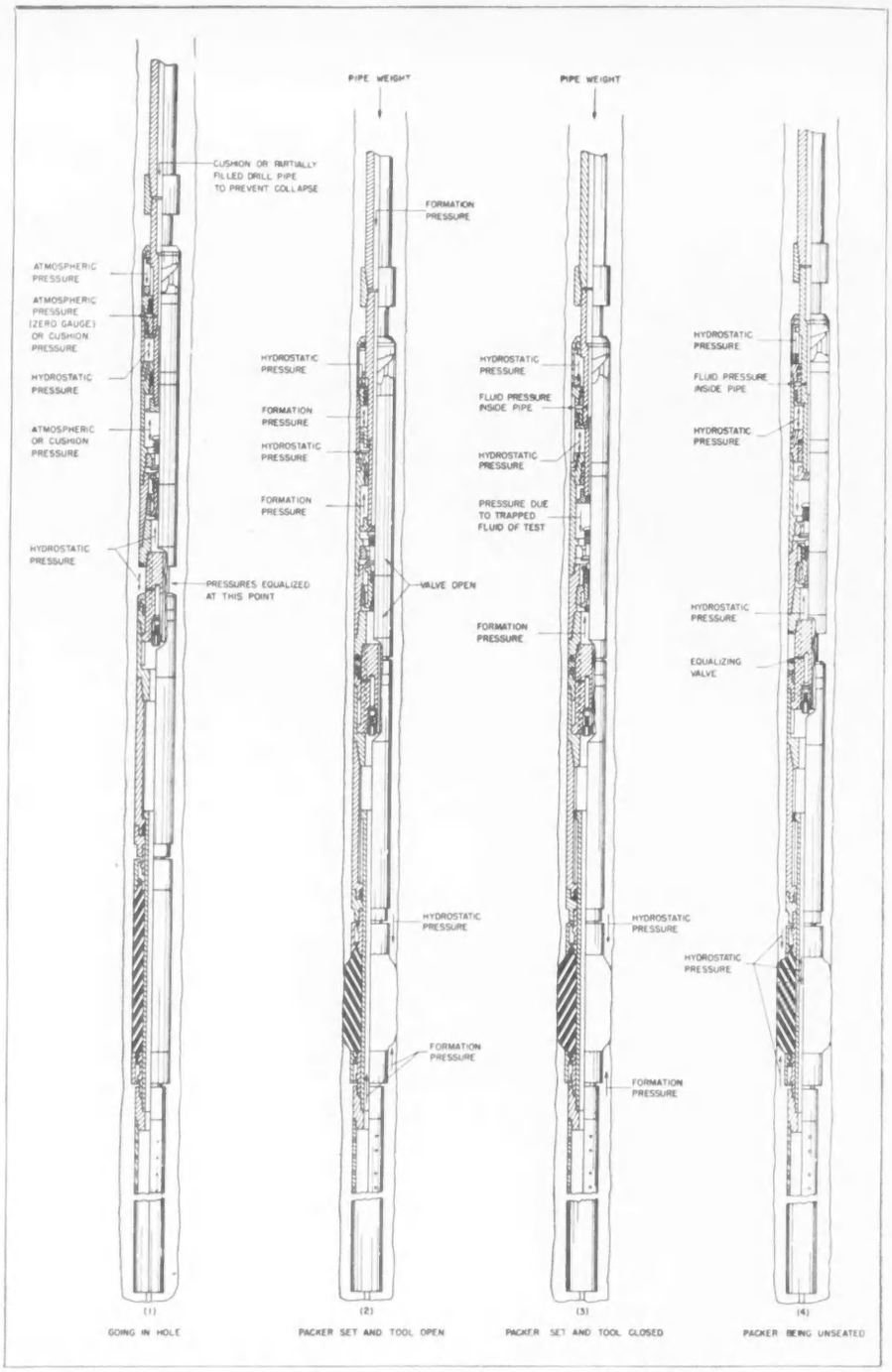


FIGURE 5

The areas, points of pressure, and force application are shown for those interested in mathematically determining the differential area. This area is $(A_1 - A_3)$. It is the pressure reaction within this chamber that separates the case and the tester neck keeping the tool closed while running in the hole. A few numerical examples are given to illustrate some of the principles previously described.

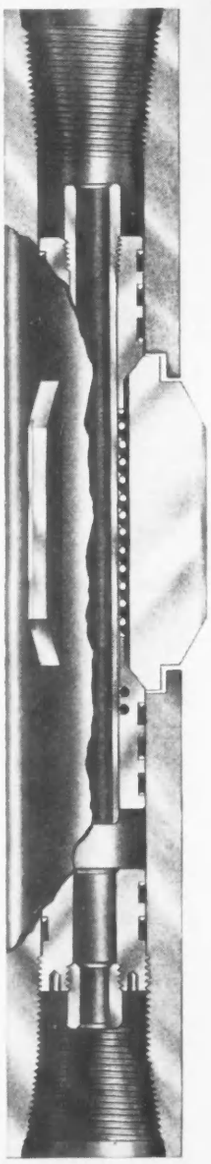
Example 1: Suppose the area (A_2) of the tool is 27.08 square inches and that of the top $(A_2 - A_4)$ is 17.47. This means that there is an unbalanced area of 9.61 sq. in. on which pressure will exert a force. By introducing the area $(A_1 - A_3)$ equal to 11.61 sq. in. in the differential chamber, an unbalanced area of two inches remains with the result that pressure pushes up on the neck and down on the case.

One function of the differential chamber is to keep some downward force acting on the packer when picking up to obtain the closed in pressure for the test. This force remains constant for a given pressure differential area.

A testing tool applying these principles is shown in Figure 4.

Example 2: Assume we are running the tester with a 2-inch differential area in a 5000-foot well with 10 pounds/gallon mud in the hole. The hydrostatic head is 2600 pounds per square inch. This is a force of 5200 lbs. required to move the "J" pin (Figure 4) from A to B, or about 2½ points on a weight indicator with six lines.

Example 3: In an 8000 foot well with a hydrostatic pressure of 4150 psi. (10 lb. mud) and a pilot valve area of .6 sq. in. the force required to open the valve will be 2490 lbs. or about 1⅓ points with six lines. This will be in addition to the force required to overcome the effect of the pressure on the differential area. The sum of these two forces acts to expand the packer into contact with the bore of the well. Sometimes additional load must be placed on the packer to perfect the fluid seal. As soon as the pilot valve is opened the 2490 lbs. of weight on the mandrel is then imposed on the main valve stem, but due to this main valve having an area of 2.5 sq. in. the 2490 lbs. of weight will not open this



One of the easiest and most effective ways you can safeguard well completion work is to run a Grant Casing Scraper above the bit when drilling out cement! This efficient tool — under full control of the operator at all times — completely removes cement, mud and other foreign material from the casing wall . . . smooths off burrs made by gun perforating . . . paves the way for free, unobstructed passage of pipe and tools . . . insures positive slip engagement of packers and other production equipment. *It's not only a valuable tool for new well completion, but also for use on work-over jobs during the producing life of the well!*

OPERATED BY PUMP PRESSURE

When running in the hole, the blades remain retracted and are expanded by simply applying mud pump pressure whenever scraping is to begin. Thus, the blades do not ride the casing going into the hole, eliminating blade wear and insuring full scraping efficiency. Blades retract easily on removal of pump pressure. Moreover, any degree of scraping pressure can be obtained by simply adjusting pump pressure, providing proper scraping action for any operation. Pump pressure adjustment is not critical, the tool operating properly over a wide pressure range. The Grant Casing Scraper can also be adapted to run safely on tubing.

Grant Casing Scraper bodies are machined from alloy steel, heat treated for strength and long wearing life. Scraping blades — securely locked in the body to prevent loss — are made of carbon steel, hard-faced for full cutting efficiency. *For safer, easier, more economical completion and workover jobs, get full details on the Grant Hydraulic Expansion Casing Scraper from the Grant representative in your territory. Send for Bulletin No. 17 giving body sizes, scraping ranges and complete descriptive information.*

Proven GRANT Tools
Used Where Performance Counts

Hydrostatic Bailers	Bulletin No. 11
Liner Pullers	Bulletin No. 14
Pressure Releases	Bulletin No. 15
Casing Scrapers	Bulletin No. 17
Wall Scrapers	Bulletin No. 20
Bottom Hole Scrapers	Bulletin No. 21
Underreamers (Rotary)	Bulletin No. 24
Underreamers (Cable Tool)	Bulletin No. 27
Hole Enlargers	Bulletin No. 38
Reamers	Bulletin No. 43
Hydrostatic Perforation Cleaners	Bulletin No. 50
Dump Bailers	Bulletin No. 51
Roller Cutter Shale Bits	Bulletin No. 54
Sand Pumps	Bulletin No. 55
Impression Block Tool	Bulletin No. 56
Well Cleanout Equipment	Bulletin No. 57

Write for Descriptive Bulletins on these GRANT Tools

GRANT OIL TOOL COMPANY

Main Office and Plant: 2042 East Vernon, Los Angeles 11, California

Branches at Bakersfield, Avenal and Ventura, California, and at Odessa and Houston, Texas

valve until pressure under the valve has been reduced to 996 lbs. or 2490 ÷ 2.5. At this pressure the valve will automatically open.

Reducing Force

If a "cushion," partial filling of the pipe, is run in the drill pipe it will act on the plug (Figure 3) and tend to reduce the force required to open the valve because it reduces the effective force on the differential area. In other words, it adds to the force available to overcome the opposing forces on the differential area and the valve area A_s.

When the packer is set the pressure may increase below the valve because of the piston action of the pipe and packer. This will be in excess of the hydrostatic pressure.

If a single large diameter valve were used, it would not be possible to open this tool at extreme depths and pressures; consequently, a "nest" of valves (a small diameter valve within the main valve) is employed to reduce the force required to open the tool (Figure 4). This small valve or "pilot valve" reduces the effective area exposed to pressure thus reducing the force required to open the valve system. As the pressure below the larger valve is dissipated through the pilot valve the larger valve is then opened with little resistance. By varying this valve area, for both the pilot valve and the large valve, the total force to open the tool can be varied.

There are at least five cycles which a testing string must go through when making a drill stem test. The first four are illustrated in Figure 5 and are (1) running in the hole; (2) change of pressure conditions due to setting of the packer and opening of the tool; (3) closing of the tool; (4) unseating of the packer, and (5) coming out of the hole.

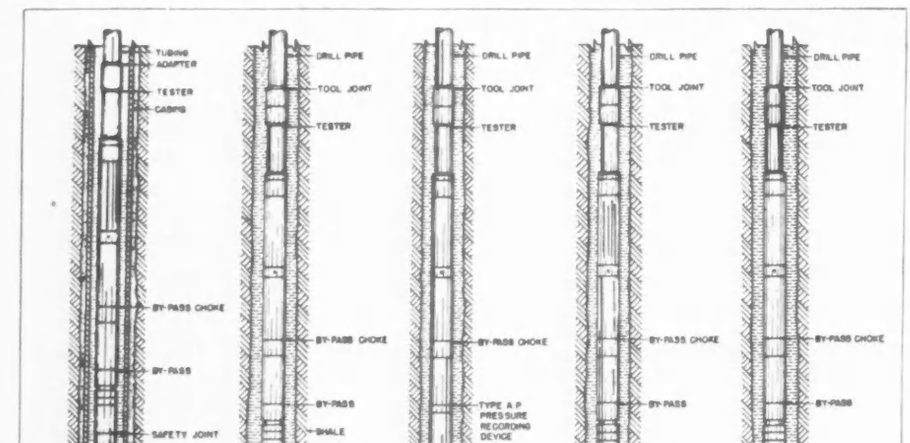


FIGURE 6

In Figure 5 the directions of the pressure are indicated by the direction of the arrows.

In the analysis of the forces on a testing string the effects of hydrostatic pressures only are considered, as the effects of velocity pressures are not of much consequence when determining these forces. The basic fundamentals discussed apply to any of the systems shown in Figure 6.

Equalizing Valve

An equalizing valve or by-pass illustrated in Figures 5 and 6 is often desirable in a "string" of testing tools. If one is not used, it is necessary to lift the entire column of fluid outside of the drill pipe to unseat the packer.

On a deep well there is a greater weight of drill pipe to be lifted and because of physical limitations of derrick and drawworks, there is less force available to pull a packer free from the formation. The by-pass for fluid will permit hydrostatic pressures to be balanced above and below the packer and permit it to be removed with a minimum of lifting force.

A by-pass may be designed so that it is pressure balanced. In this respect the areas on which pressure acts are so proportioned that the force required to open the tool will be very small. The principles above outlined apply to practically all testing tools in current use. Another type of tester, not discussed herein, is the wet tester. A description of this tool is given in Reference 1.

Packer Loads

In drill stem testing three types of packing elements (packers) are used to seal off the fluid column from the formation being tested. They are

(1) hookwall, or casing packer,
(2) cone packer, and
(3) open hole or sleeve packer.

The hookwall packer, composed of a series of rings or a sleeve, has the better chance for successful performance because it is set in casing. The clearance between the packer shoe and the casing is much closer, is uniform, and there is excellent support. The same forces apply to a hookwall packer as apply to an open hole packer.

The cone packer is rarely used. The open hole packer set in a rat-hole has supplanted this type of packer.

The open hole packer, sleeve type, has the toughest job of the three types of packers used in drill stem testing. In many cases it is required to seal off in a formation which is elastic and which will deform under pressure in the immediate vicinity of the well bore. Frequently it is set in a hole whose diameter is known only approximately. This affects the clearance between the sup-

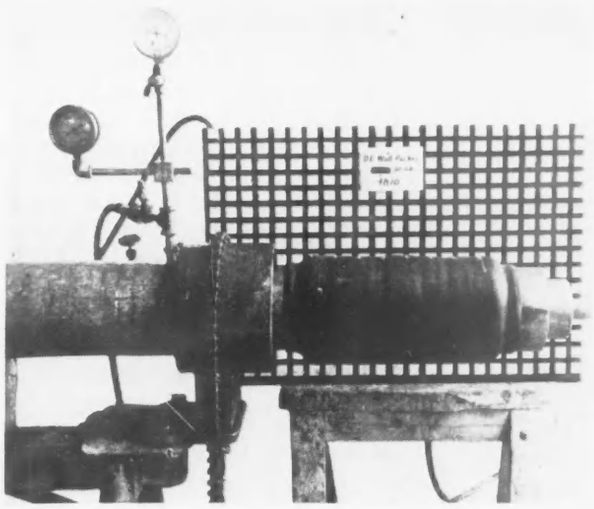


FIGURE 7

porting member, the packer bottom shoe, and the well bore. The factor of clearance will be discussed further in this article. When such a packer is initially set it appears as shown in Figure 7. After the valve of the tester is opened, the packer assumes a shape as shown in Figure 8. A packer was placed in a pressure chamber so that it could be loaded in the same manner as in a well. Equally spaced marks were painted on the packer and marks to correspond were placed on the outside of the chamber along a transparent window. Note that in Figure 9 the spacing of the marks has decreased at the bottom and increased at the top of the packer.

Rubber Characteristics

Rubber is a peculiar substance. In packer design, it must be considered a fluid, yet it has some of the characteristics of a solid. There are two phases of rubber, the elastic and the plastic. We are interested in the elastic phase because it is the property which causes a packer to restore itself to original shape when the pressure is equalized in a test. Under the same conditions, the rate of recovery of packers using natural rubber is faster than that of packers using synthetic compounds. Consequently a little more time must be allowed for synthetic packers to resume normal shape and prevent tearing the packer to pieces in the hole when pulling the packer loose.

Under high temperatures and high static loads, rubber will creep or flow quite readily. The rate of creep will depend on the type of compound and whether it is of a rubber or synthetic base. The temperature of the packer will depend on the rate it is run in the hole, its mass, the length of time on bottom, the length of time the well was circulated, and the temperature of fluid from the test. If the packer is reinforced with fabric, there is a loss in strength at high temperature, especially with cotton fabrics. This does not mean that fabric reinforcing is detrimental.

If rubber is placed and kept under constant load slightly less than its breaking load, it will break in a comparatively short time due to the high static stress. This condition could occur on a production test.

These factors all add up to one thing: *The clearance between the well bore and the packer should be kept as small as practical.* The best way to do this is by intelligent use of the electric log and caliper log when selecting the packer seat. If these are not available, a packer seat should be selected by the drilling log showing the rate of penetration of the bit. Proper mud control is very essential for securing a packer seat.

Hard non-fractured shales, hard sands, hard sandy shales, lime, and dolomite make the best seats. Some shales soften while drilling due to water absorption, and if the packer is set in this type of shale, the seat is likely to fail due to plastic flow of the formation under the pressure exerted on it by the packer. This is also true of partially consolidated sands. This is illustrated in Figure 10. Note that as the formation flows or is displaced, the packer tends to replace the displaced material up to its failure point.

It is difficult to establish any kind of an empirical relation for the ratio of hole size to bit size for a given type of formation. For hard formations this might be possible; however, there are many variables and it is best to secure a caliper log. This is particularly true on wildcat wells where loss of rig time may be involved because of a mis-run.

The forces acting on an open hole packer when centralized in the hole are shown in Figure 8. If the packer is of proper size, this is the most favorable condition because the clearance space to be "bridged over" is the least. An unfavorable condition is shown in Figure 11. Note that the clearance is all on

TABLE 1

Packer Sizes[3]

(Where **small** hole is carried for **short** distance below larger drilled hole.)

Diameter of Small Hole	Diameter of Wall Packer
8¾"	8½"
8⅛"	8"
7⅞"	7½"
7"	6½"
6¾"	6½"
6¼"	6"
6"	5½"
5⅞"	5½"
5½"	5"
5"	4¾" or 4¼"
4¾"	4¼"
4¼"	3¾"

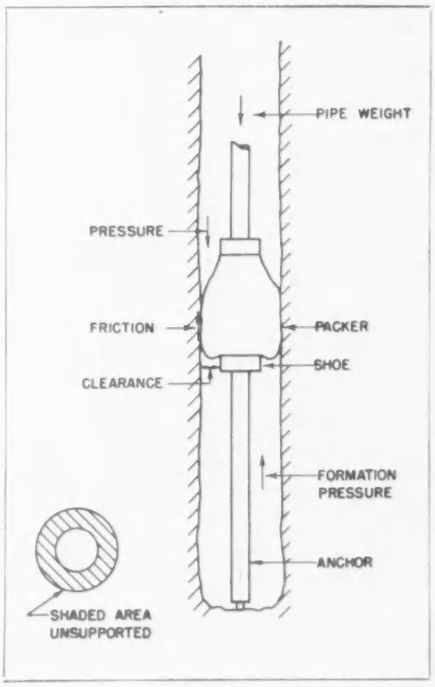


FIGURE 8

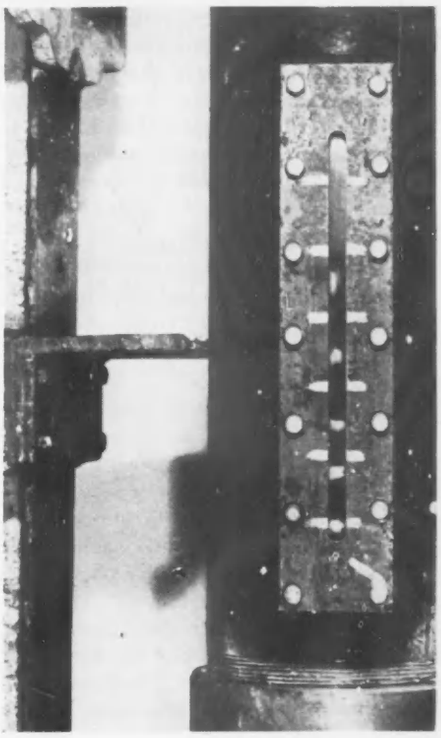


FIGURE 9

one side, thus overloading one side of the packer and allowing it to extrude through the open space. This condition depends on the size of the well bore above and below the packer. Figure 12A illustrates another unfavorable condition that probably causes the complete destruction of the packer when the tester valve is opened.

When testing a thin sand that has a shale formation above the pay zone, it is best, if possible, to set the packer a few inches in the zone to be tested as shown in Figure 12B.

Frequently two wall packers are run as illustrated in Figure 13. If the test is successful and the lower packer has held, the upper packer is not likely to be damaged. This is because the fluid trapped between the two packers tends to exert a "back" pressure on the upper packer, thus protecting it. There will be a slight pressure differential on the upper packer because of the packer stiffness and wall friction. The lower packer carries the total hydrostatic pressure minus this small differential mentioned. If the lower packer fails the upper packer assumes the load.

Wall Friction

The effect of wall friction in contributing to the support of the packer is not known. This depends upon many factors including mud quality and the type of formation. In hard formations it may be appreciable.

A packer can be subject to an impact load, due to the sudden drop in pressure below the packer as the tester valve is opened. The magnitude of this impact load depends on the size of the opening in the tester valve and the hydrostatic pressure above the packer. Another factor is the rate of formation pressure "build up." A "dry" test (no formation pressure) is the worst of conditions encountered by either a casing or open-hole packer. In this case the packer must support the entire hydrostatic head. The rate of load application depends upon a combination of these factors. The use of a "cushion" of water or mud in the drill pipe reduces the hydrostatic load applied to a packer.

TABLE 2
Packer Sizes[3]
(Packer data for average operations.)

Diameter of Drill Hole	Diameter of Wall Packer
9⅞"	8½"
9½"	8½"
9¼"	8½"
9"	8"
8¾"	8"
8⅝"	8" or 7½"
8¼"	7½"
8"	7½" or 7"
7⅞"	7"
7½"	7" or 6½"
7"	6"
6¾"	6"
6¼"	5½"
6"	5½"
5⅞"	5" or 5¼"

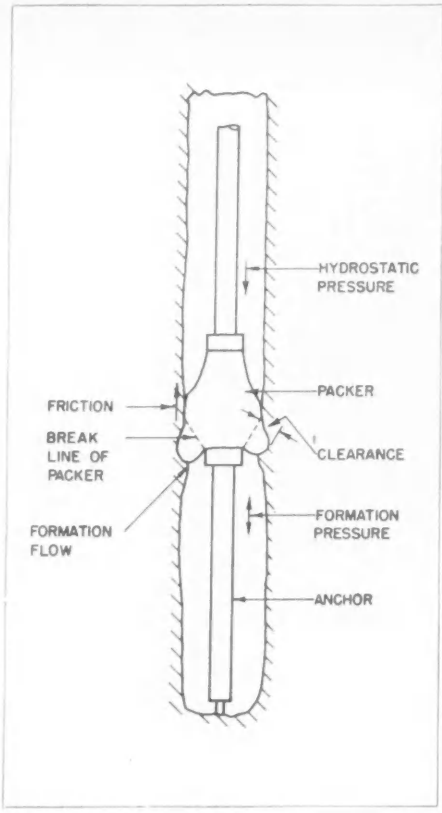


FIGURE 10

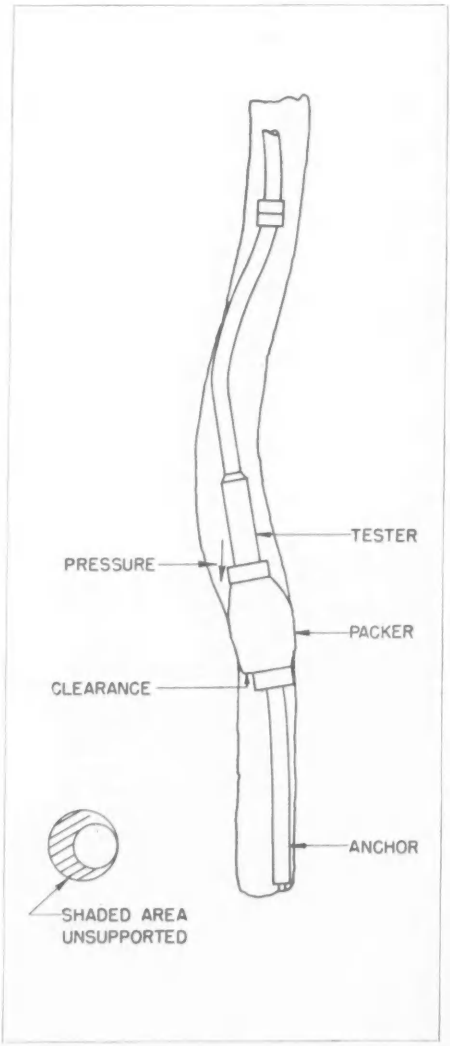


FIGURE 11

Four of the most common types of packer failures are shown in Figures 14 to 17 inclusive. The failure shown in Figure 14 could be due to an overload on a dry test or to excessive hole size. Figure 15 could have been caused by a condition as shown in Figure 11. Failures shown in Figures 16 and 17 could be due to conditions illustrated in Figures 10 and 12A.

An equalizing valve should be used during a test because failure to do so will usually result in damage to the packer. Referring to Figure 8, it will be noted that the packer tends to extrude into the clearance space under load. If the pressure is not equalized and the load relieved, thus taking advantage of the natural restoring force in the packer, the extended portion will be torn off as the packer is pulled from its seat, unless the formation fails first. As this part of the packer fails, the pressure is equalized.

To determine the load on a packer, the forces acting vertically both up and down should be determined and the difference noted. Normally this load is shown on the weight indicator.

Tables III and IV give the recommended relation between hole size and packer size. For wells in which the hydrostatic pressure is greater than 2500 psi., it is best not to exceed the hole size for the packer size given.

The maximum expanded diameter of a packer compressed to 50 percent of its normal length depends on the amount of fabric reinforcement, its arrangement, and the length of the packer. If the diameter of a packer is known, the expanded diameter of a different size packer of the same construction may be approximated by simple proportion.

Fifty percent of normal length is specified because further compression does not increase the diameter at a rapid rate and the packer is not liable to carry high loads at its maximum expanded diameter. However, sometimes additional drill pipe weight can be applied to the packer to effect a seal.

The approximate travel required to set a packer can be determined by assuming that the packer remains a cylinder after collapse. Refer to Figure 18.

TABLE 3
Rubber Stresses and Compression

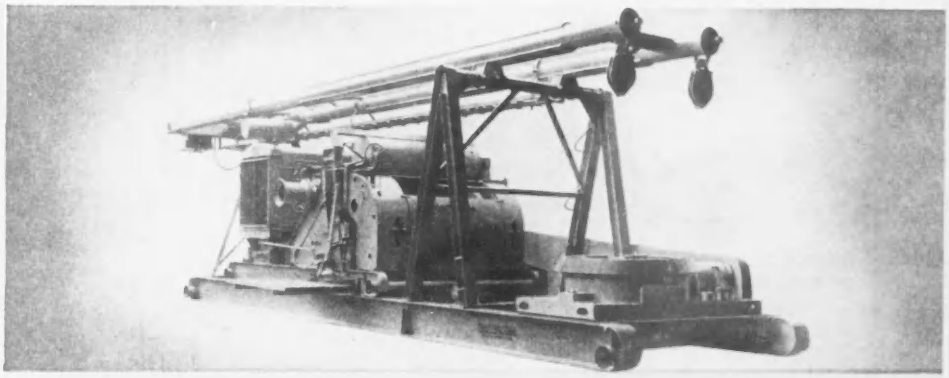
Durometer	Percent Normal Length	Stress
50	50 percent	480 psi.
60	50 percent	500 psi.
70	50 percent	1000 psi.
80	50 percent	1300 psi.

. first in profits, too!

"CARDWELL" BUILDS A HOIST TO FIT EVERY JOB . . .

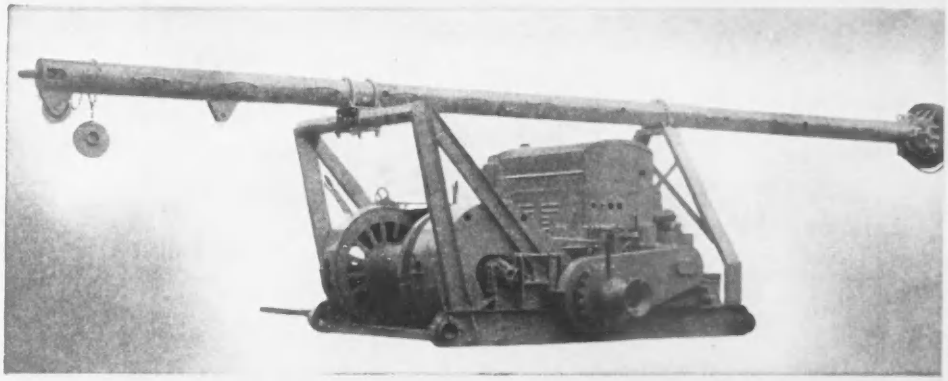
MODEL S . . .

A heavy-duty "Cardwell" hoist, light enough for portability and big enough to service 12,000-foot wells. Model S is shown with subframe providing support for 55-foot double leg mast and rotary table. Rotary drive assembly optional.



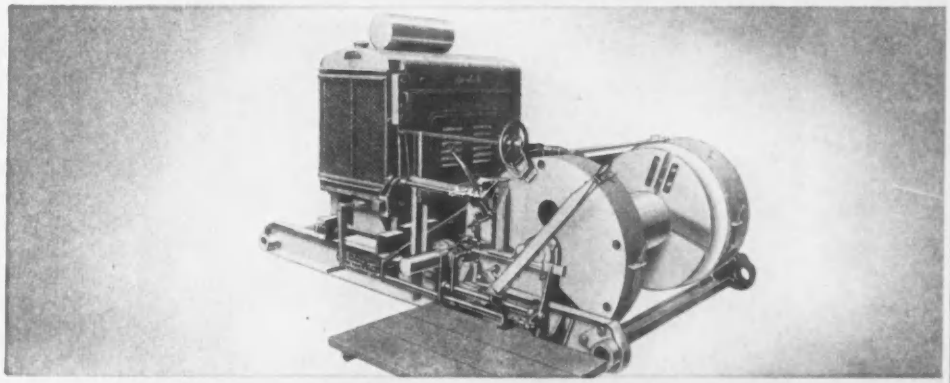
MODEL K . . .

This lightweight, rugged hoist has a well depth capacity for serving 90% of all wells. A versatile machine, suitable for truck or trailer mounting, or derrick floor operations. Rotary table drive sprocket, 48- or 55-foot single leg, or 55-foot double leg masts are optional. Recommended for well servicing to 6,500 feet.



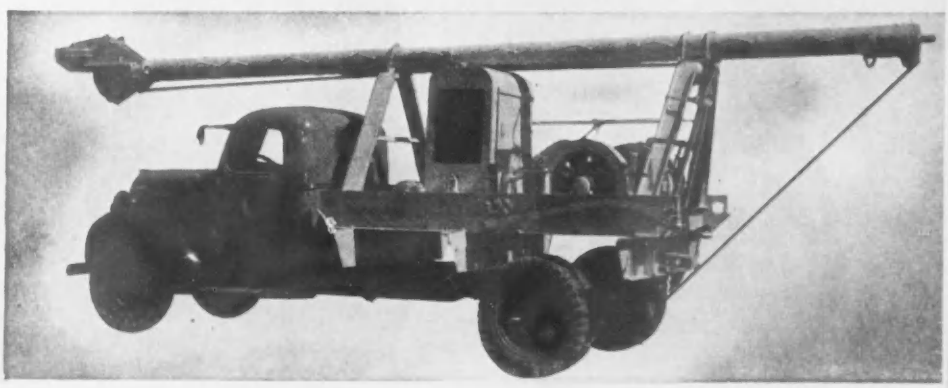
MODEL H . . .

A popular-size hoist for well servicing to 5,000 feet. Rotary table drive sprocket is available for light workover or reverse circulation jobs. Single- and double-leg masts are optional.



MODEL Q . . .

This small "Cardwell" hoist is an ideal machine for rods and tubing, bailing and swabbing. Can be mounted on a two-ton truck or trailer. 48-foot single-leg mast is optional. Hoist is recommended for well servicing to 3000 feet.



CARDWELL

REG. U. S. TRADE MARK PAT. OFFICE

THIS TRADE MARK INSURES HIGHEST QUALITY AT LOWEST PRICE

CARDWELL MFG. CO. INC.

P. O. Drawer 2001 . . . Long Distance Telephones 128—129—130

Cable Address: "ALL STEEL," Wichita — "CARDSTEEL," New York

Wichita, Kansas, U. S. A.

WHEN IT'S A "CARDWELL," THERE'S NO EQUAL IN QUALITY

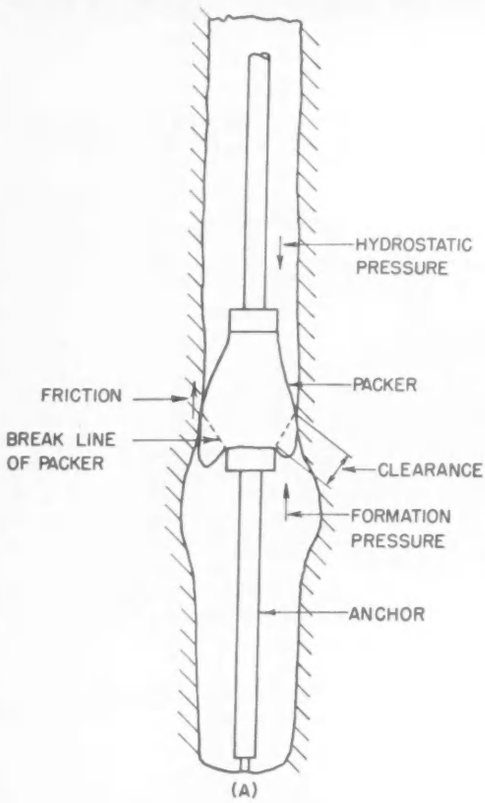


FIGURE 12A

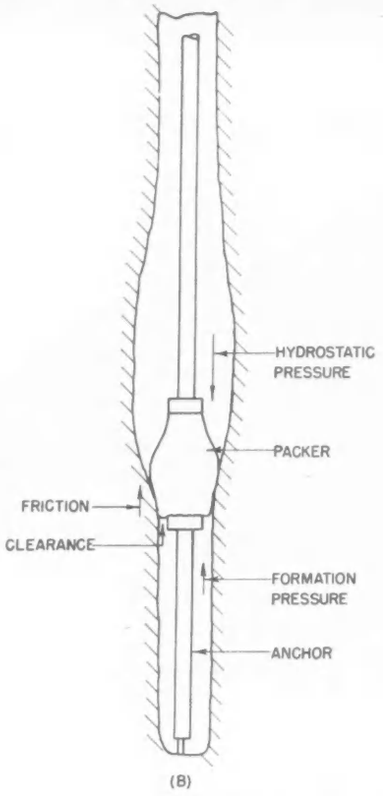


FIGURE 12B

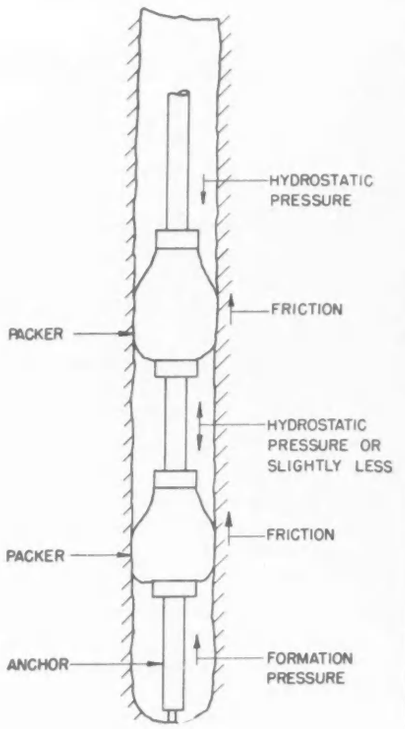
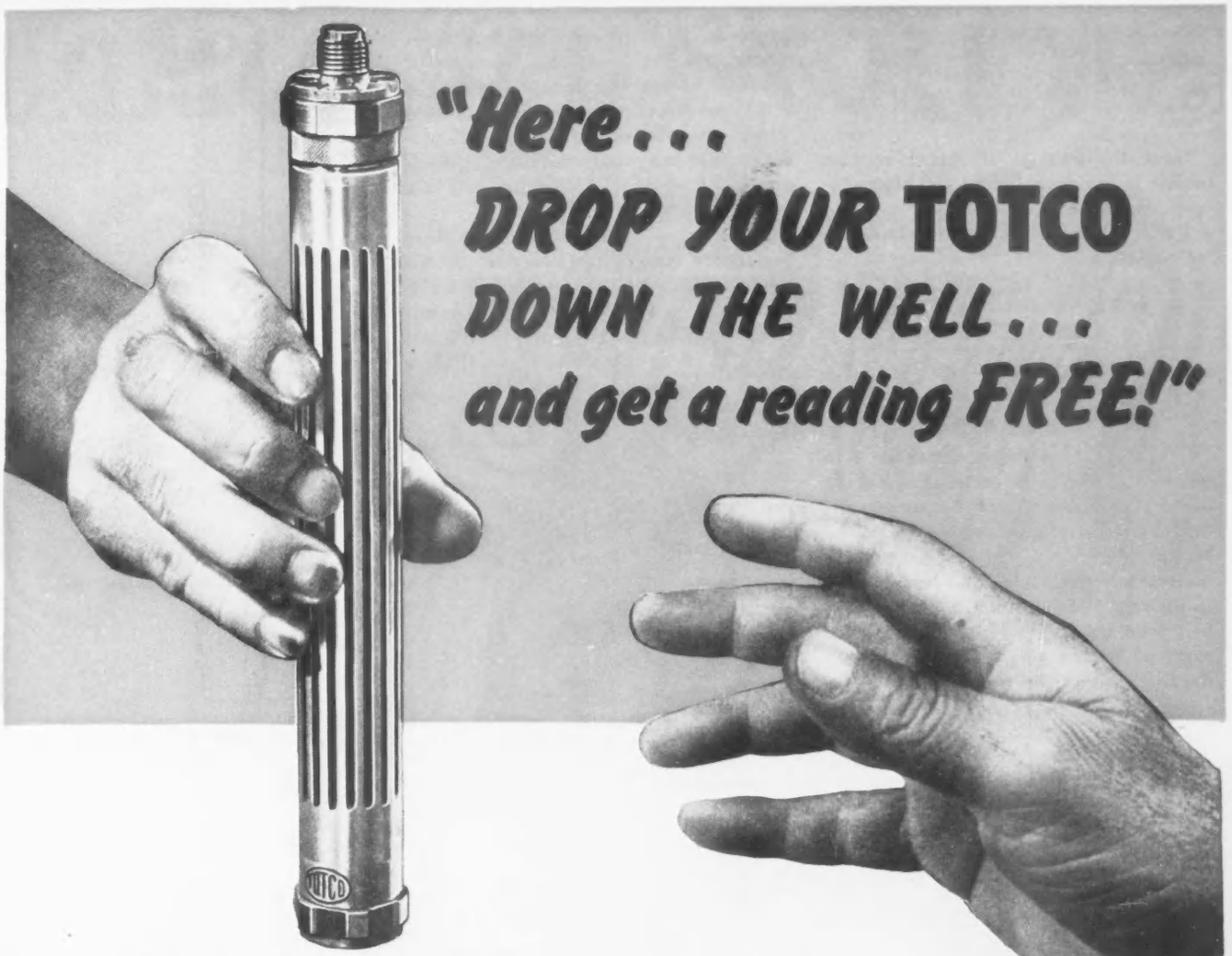


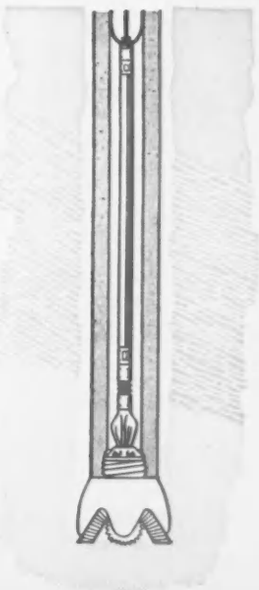
FIGURE 13

FIGURE 14

FIGURE 15



"For Pete's sake, man, don't pass up a chance to get something for nothing. You're going to pull the string to change bits; you've got the equipment for dropping the Totco, haven't you? Well then, DROP it before you pull the bit. It costs you only a few minutes more — disconnect the kelly, drop in the go-devil, re-connect the kelly and run back to bottom. Thirty seconds after your Totco has recorded, start out of the hole. How much time is all that . . . not more than a few minutes. Well, you'll certainly trade a few minutes for an accurate bottom-hole record. Why, it's getting your reading practically for FREE! . . . No, you won't get *all* your Totco readings by dropping it — unless you're making mighty frequent round-trips with the bit. But you will get a lot of them, at next to no cost in time. So drop that Totco, man!"



TOTCO

TECHNICAL OIL TOOL CORP., Ltd.

1057 N. LA BREA AVENUE • LOS ANGELES, CALIFORNIA

Exclusive Distributors: California — REPUBLIC SUPPLY COMPANY OF CALIFORNIA • Domestic (outside California) — CONTINENTAL SUPPLY COMPANY • Canada — OIL WELL SUPPLY COMPANY • Export (except Canada) — LUCEY EXPORT CORP., New York

L = Initial length
L_1 = Final length
d = Mandrel diameter
D = Initial O.D. of packer
D_1 = Final O.D. of packer

Since the volume of rubber on the packer is the same before and after collapse, we have:

Volume before collapse = Volume after collapse

$$\frac{\pi}{4}(D^2 - d^2)\,L = \frac{\pi}{4}(D_1^2 - d^2)\,L_1$$

Eq. 1.0 $$D_1 = \sqrt{\frac{L}{L_1}(D^2 - d^2) + d^2}$$ (Expanded O.D.)

Collapsing Packer

The force to collapse a packer is a function of the cross-sectional area, the durometer (hardness) of the packer, and the required deflection. This force can be considered directly proportional to the cross-sectional area and proportional to the required deflection. Although rubber does not follow Hooke's law, for practical purposes up to 50 percent deflection, it can be so considered. To compress a 7-inch packer (fabric reinforced, 70 durometer) to 50 percent length, requires about 38,500 pounds or about 21 points (six lines). This is for a maximum expanded diameter of 10½ inches. To collapse the packer to 25 percent the length would require 38,500 ÷ 2 or 19,250 pounds (12 points with six lines).

A listing of rubber stresses or load per square inch of cross-section for different hardnesses is given in Table III.

If a caliper log is available this information can be usefully applied, if a test is being made on a shallow well, as follows:

FIGURE 16

FIGURE 17

Assume 1500 feet of 4½ 16.60 drill pipe, on 11 inch packer in 13 inch hole, 10 lb. mud. Packer hardness is 50 durometer, length 30 inches.

Will the packer seal off in the well?

Solution: Using Table III and Eq. 1.0

Packer normal length = 30 inches
Mandrel of tool = 3½-inch O.D.
Cross sectional area of rubber

$$A = \frac{\pi}{4}(11^2 - 3\tfrac{1}{2}^2) = 85.38 \text{ sq. in.}$$

Pipe weight = 1500 × 16.60
W = 24,900 lbs.
Floating weight = W — Ahd

$$hd = 5.2 \times \frac{1500}{100} \times 10 = 780 \text{ psi.}$$

(static pressure)

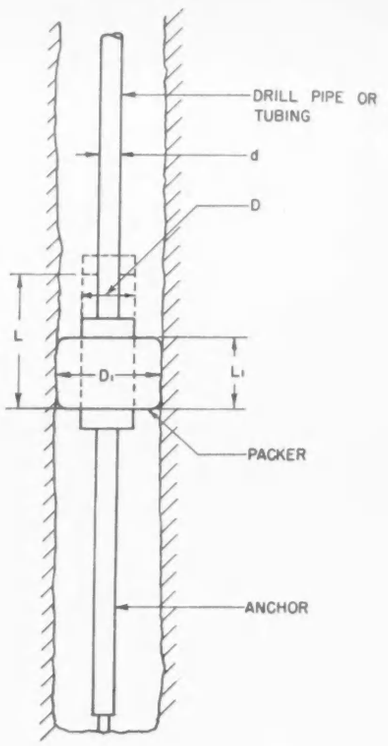


FIGURE 18

$$A = \frac{4.5^2 \times \pi}{4} = 15.9 \text{ sq. in. (pipe area)}$$

$$W - Ahd = 24{,}900 - 15.9 \times 780$$
$$= 24{,}900 - 12{,}400$$
$$= 12{,}500 \text{ lbs.}$$

$$\text{Stress} = \frac{12{,}500}{85.38} = 147 \text{ psi.}$$

Collapsed length (assuming direct proportionality of stress)

$$L_1 = L - \frac{S_1}{S_{.5}}(L - L_{.5})$$

$S_{.5}$ = stress at 50 percent compression

S_1 = stress at any intermediate value of compression

L and L_1 as previously noted

$L_{.5}$ = length at 50 percent compression

$$\therefore L_1 = 32 - \frac{147}{480}(32 - 16)$$
$$= 30 - 4.9 = 25.1$$

$$\therefore D_1 = \sqrt{\frac{30}{25.1}(11^2 - 3.5^2) + 3.5^2}$$
$$= 11.9 \text{ inches}$$

Since the hole diameter is 13 inches and the pipe weight is sufficient to expand the packer to a diameter of 11.9 inches, a heavier "string" of pipe will be required. A softer packer or a reduction in packer section could also solve the problem.

NOTE: This method is an approximation as no consideration is given the form factor of mandrel-supported rubber cylinders. This information is not available at this time. Form factor is a function of the shape. It compares to efficiency factor.

(To be Concluded Next Month)

HOMCO DRILL COLLARS

GUARANTEED IMPACT

HOMCO DRILL COLLAR SPECIFICATIONS

1. Uniform, full length heat treatment and liquid quenched to 277 to 321 Brinell hardness.
2. Minimum impact values (Izod) of 40 foot-pounds guaranteed; the average drill collar will have impact values far in excess of this minimum.
3. Threads milled on joints and all A.P.I. connections checked with A.P.I. master gauges.
4. All drill collars subjected to complete inspection, including Magnaflux, before delivery.

THE entire drilling industry has only recently awakened to the importance of high impact values in drill collars. This has been brought about by examination which proved the failures were due to low impact values.

Through arrangements with one of the larger steel mills, HOMCO is now able to offer drill collars in practically all standard sizes with a guaranteed minimum impact value of 40 foot pounds, as demonstrated by a specimen taken at a point midway between the inside and outside surfaces of a prolongation; plus physical specifications equal to or better than other top quality drill collars.

The HOMCO Drill Collars are provided with thread milled connections and A.P.I. joints bear the monogram, indicating A.P.I. master gauges have been used to check their correctness and insure perfect joint alignment. Each drill collar is fully inspected, including Magnaflux inspection, before being sent into the field.

Where hard surfacing bands or flame hardened connections are desired, these may be provided to the customers specifications at additional cost.

HOMCO maintains large stocks of all standard size collars, assuring prompt delivery.

HOMCO

TRADE MARK REGISTERED U. S. PAT. OFFICE

HOUSTON OIL FIELD MATERIAL COMPANY, Inc.

OIL INDUSTRY'S MOST *Complete* SERVICE

HOUSTON, TEXAS **P. O. BOX 2589**

Liquid Surface Measurement Set At One-Millionth of Inch

IT HAS been determined that the depth of a liquid surface is approximately 1000 atoms, or in the neighborhood of one-millionth of an inch. This measurement, made at the Stanford Research Institute with an instrument so rare that it is as yet unnamed, indicated that molecular attraction takes place over a wider range than has ever been proved before.

The discovery may have practical applications, the scientists at the Institute believe, in the fields of lubrication, oil exploration, and biology, where the reaction of liquid surfaces in contact with other materials is an important factor.

The Stanford scientists are working on an Office of Naval Research contract under the over-all supervision of Dr. J. W. McBain, professor of chemistry emeritus who is consultant on the research. They have also produced evidence that because of the effective long-range influence of molecules upon one another, the strength of a joint depends as much on the strength of the metals being joined as it does on the strength of the adhesive.

Dr. McBain pointed out that this phase of the work indicates that, scientifically speaking, a chain is not merely as strong as its weakest link, for the proverbial weak link can be strengthened somewhat by having strong links next to it.

The scientists did not do their testing with chains but, for example, with tiny cubes of copper and tungsten joined together with a thin coat of soft shellac.

With copper tubes, the breaking point of the shellac was 6000 pounds per square inch. With two tungsten cubes, the shellac joint broke at 300 pounds per square inch. When one of tungsten and one of copper were used, the breaking point of the joint increased to 900 pounds.

Dr. A. Paul Brady, research project director, pointed out that the only explanation for this phenomenon was that molecules of the polished copper cube had influenced those of the shellac, and strengthened the binding force between them.

Curiously enough, the finding proves that 19th century scientists were correct in their belief that the influence of molecules, the smallest possible unit of any chemical substance, can extend to just about the distance which can be observed in a good microscope.

Under the leadership of Langmuir, this theory was later discarded and general scientific opinion for many years has been that the depth of a liquid surface was about one-billionth of an inch because molecular attraction was believed to be effective only over this very short range.

Actual measurements of the depth of liquid surfaces are being made at the Research Institute with a rare apparatus which measures the minute distortion of polarized light reflected off liquid surfaces.

Under classical mathematical theory, the surface was assumed to have no depth at all, but the fact that there is a measurable distortion of the polarized light conflicts with this theory.

Dr. McBain explains his theory of effective "long-range" molecular attraction by comparing it to a magnet's influence on a cluster of nails.

He points out that the magnet has a very short range direct attraction on nails, but can pick up a nail at some distance provided that there is a series of nails, each touching one another, extending out from the magnet.

Molecules in a liquid surface behave very much in the same fashion, Dr. McBain believes, and since they are unevenly shaped and each polarizes several neighbors, which in turn polarize others, their chain-like relayed action extends over what is an "impressive distance," scientifically speaking. This amounts to one-millionth of an inch compared to what scientists have previously considered "short-range"—one-billionth of an inch.

Dr. Brady pointed out that practical applications of the findings in lubrication problems revolve around the fact that it is the liquid surface which is in direct contact with wearing surfaces, and the characteristics and performance of this liquid surface are important considerations.

G. A. Davis' Talk to Open PEPA Meeting

G. A. Davis, president, Oklahoma Gas and Electric Company, Oklahoma City, will make the first address at the 20th anniversary meeting of the Petroleum Electric Power Association, December 1-3, at the Biltmore Hotel, Oklahoma City.

The session will get under way officially with registration at 9 a.m. December 2 and will adjourn at 4 p.m. December 3 after the election of officers.

Following Davis' address, the December 2 morning events will include the following talks: "Advertising Plan and Budget for 1949," by Ted Workman, Ted Workman Advertising Company, Dallas; a talk, "Relation of Assessments and Dues to Budget," by J. B. Moore, secretary-treasurer, PEPA; "Petroleum, Power and the Universe," by Dr. Irving Perrine, Oklahoma City; and "A Few Suggestions for Power Association Betterment," by D. C. McKee, president, Empire District Electric Company, Joplin, Mo.

The afternoon program, a "Symposium on Oil Production with Electric Power," will contain a talk, "Essentials of Selling Power," by R. E. Patrick, Kansas Gas and Electric Company, Wichita, Kansas, with discussions by Ned W. Beaupreau, Central Power and Light Company, Corpus Christi, Texas, and J. W. Lambert, Southwestern Public Service Company, Borger, Texas; and a talk, "Electric Equipment for Production," by J. H. Poore, General Electric Company, Dallas, with discussion by R. A. Swindell, Westinghouse Electric Corporation, Dallas, and Jas. E. Moody, Southwestern Gas and Electric Company, Shreveport.

The evening activity will include a banquet and addresses, "My Year As President," by A. R. Watson, vice president, Southwestern Public Service Company, Amarillo, and "One More Chance," by Charles T. Evans, vice president, Arkansas Power and Electric Company, Little Rock.

The December 3 morning session will have the theme, "Symposium on Pipe Line Pumping with Electric Power," and will include a talk on "Essentials of Selling Power," by T. E. Graham, Oklahoma Gas and Electric Company, Oklahoma City, with discussion by B. F. Thompson, Public Service Company of Oklahoma, Tulsa, and T. V. Grayson, West Texas Utilities Company, Abilene, Texas, and a talk on "Electric Equipment for Pipe Lines" by M. A. Hyde, Westinghouse Electric Corporation, East Pittsburgh, Penn., and F. G. Giger, manager of sales and engineering, Allis-Chalmers, Norwood, Ohio, with discussion by V. G. Murdock, assistant engineer in charge, Allis-Chalmers, Norwood, and J. B. Struwe, Southwestern Gas and Electric Company, Shreveport.

The afternoon session, a "Symposium on Refining with Electric Power," will contain an address, "Essentials of Selling Refinery Power," by C. L. McNeese, Houston Lighting and Power Company, Houston, with remarks by H. C. LeVois, Gulf States Utilities Company, Beaumont, and discussion from the floor.

SIMPLICITY OF DESIGN is the key to the perfection found in our Straight Grip Tool Joints! Our simplified design so controls the reduction of area that the SEAL BECOMES TIGHTER as high tension loads and pump pressure increase. And this design also provides an inside seal . . . actually giving you four sealing areas! And remember, American Iron's simplified method of field installation and removal of these tool joints is as advanced as Straight Grip Joints themselves. They're designed right . . . made right . . . and installed right — for positive protection against joint leakage and creep!

THE TENSION LOAD

pump pressure . . .

THE SEAL!

AMERICAN IRON & MACHINE WORKS CO. · A · OKLAHOMA CITY U.S.A.

3 TIMES AS STRONG

AS THE PIPE THEY CONNECT!

Repeated tension tests — made with the most modern machines in existence — prove our tool joints 3 times as strong as the pipe they connect!

AMERICAN IRON & MACHINE WORKS CO.

Oklahoma City, Oklahoma — Box 1177 — Phone L. D. 518 — District Office, Houston, Texas

Export Office: 420 Lexington Ave., New York City, N. Y.

Also manufacturers of A. P. I. and "Amweld" (counterbore weld) Tool Joints

Causes and Prevention of *Drill Pipe and Tool Joint Troubles*

By H. G. TEXTER
Spang-Chalfant, Inc., and
R. S. GRANT
Hughes Tool Company
Revised by H. G. TEXTER, Chief Engineer, Spang-Chalfant Division of the National Supply Company, and S. C. MOORE, Product Engineer, Hughes Tool Company

THIS IS THE THIRD of a series of articles which describes causes of drill pipe and tool joint troubles and practical ways of preventing them. The series revises a widely acclaimed paper presented under the same title before the American Petroleum Institute's Twenty-Second Annual Meeting at San Francisco on November 6, 1941. To give readers both the new thoughts on the subject and also the benefit of the very thorough discussion presented in the original manuscript, the old text is reprinted in full in our standard type face and the revisions indented in larger type. The effective revision date is August, 1948.

Reprints of the series in pamphlet form will be available following completion of publication in WORLD OIL. Those desiring reprints should request copies as soon as possible.

Part 3 DRILL PIPE—Continued

6-c. Corrosion Fatigue

In many areas of rock-bit drilling, particularly in the Mid-Continent, the most common cause of drill pipe failure is corrosion fatigue. Just why it is confined almost exclusively to rock-bit territory is not entirely clear, but the fact remains that along all of the Gulf Coast and in many parts of California, where the formations are soft and are, or could be, drilled with fishtail or drag bits, there are almost no failures which can be attributed to corrosion fatigue. The explanation must be tied up with the fact that formations drillable with drag-type bits are relatively young, geologically, and have the following general characteristics:

a. They contain few or no salt or anhydrite sections (except salt domes which are never drilled anyway, or only through thin, overhanging sections).

b. There is almost no hydrogen sulfide, except in a few of the old shallow fields.

c. Being late, geologically, the formations are unconsolidated, and their clays make good colloids which definitely coat and protect steel from corrosion.

d. Heavy muds are almost a necessity to make the holes stand up, and this, again, aids in protecting drill pipe from corrosion.

e. And last, but not least, the drilling of soft formations, particularly with drag bits, tends to develop high torque in the drill stem. This tends to spiral the pipe in the hole, thereby preventing whip and this, in turn, reduces the stress reversals in the drill pipe; a reduction in stress reversals, in turn, reduces corrosion fatigue, as discussed hereinafter.

It now has been established quite definitely that salt, of relatively low concentration, is the principal cause of corrosion fatigue. It is most prevalent in the Permian Basin area of West Texas and New Mexico, but also occurs wherever holes are drilled through salt stringers or wherever makeup water containing salt is used. In certain areas, for lack of fresh water, as in the Bahama Islands and in Egypt, sea water has been used with very disastrous results.

Battelle[15] has found that most rapid laboratory corrosion results can be obtained with a 7 percent salt solution (6.6 percent sodium chloride, 0.1 percent magnesium chloride, and 0.3 percent calcium chloride). Lower or higher concentrations are less corrosive and concentrated salt solutions seem to be effectively non-corrosive. This partly accounts, then, for the almost non-existence of corrosion fatigue failures in Gulf Coast drilling where muds often are kept saturated with salt to prevent leaching-out of salt beds.

Of greater interest is the mechanism of corrosion fatigue and, above all, a means for reducing or preventing its effect. Sad to relate, the diagnosis is much simpler than the cure.

In its simplest form corrosion fatigue may be considered as notch fatigue in which a stress-concentration point has been formed by a corrosion pit and the fatigue progress is hastened by the corrosion. This is only part of the story, but it is a correct conception and helps explain the complete sequence of events.

In place of the sharp-file notch, in the nail which is to be broken in a vise, we now can substitute a corrosion pit. Not just any pit will serve, only a sharp-bottomed one; and if only a single pit ever formed as steel corroded, it often might not happen to be sufficiently sharp-bottomed to cause trouble. Inasmuch, however, as is the case in any small area, thousands of microscopic pits start forming at the same time,

Any V-BELT Changes Shape *when it Bends*

Prove this yourself!

That's Why the CONCAVE SIDE.

(U. S. PATENT NO. 1813698)

Gives You 2 Big SAVINGS!

Bend *any* V-Belt and *f e e l* it change shape. The top, under tension, *narrows*. The body, under compression, *widens*. The sides of the belt bulge out.

Straight-Sided V-Belt

Straight-Sided V-Belt Bulges in Sheave-Groove.

The result, if the belt is built with *straight* sides, is a shape that does not fit the sheave groove — as shown in Figures 1 and 1-A, above.

Now, bend the V-Belt built with the precisely engineered Concave Side (U. S. Patent No. 1813698) — the Gates Vulco Rope.

Gates Vulco Rope With Concave Side.

No Side Bulge. Precise Fit in Sheave Groove.

You get the same shape change but *now* the new shape *exactly fits* the sheave groove as shown in Figures 2 and 2-A.

Results— (1) *Uniform* side-wall wear; *longer* life. (2) *Full* side-wall grip on the pulley; carries heavier loads and sudden load increases without slippage—a big increase in drive efficiency—saving belt wear a n d also saving power!

REG. U. S. PAT. OFF.

The Mark of SPECIALIZED Research

The Concave Side is MORE IMPORTANT NOW Than Ever Before

Because the *sides* of a V-Belt are what actually *drive* the pulley, it is clear that any increased load on the belt means a heavier load that must be transmitted to the pulley *directly* through the belt's side-walls.

Now that Gates *SPECIALIZED* Research has m a d e available to you SUPER Vulco Ropes—carrying fully 40% higher horsepower ratings—the life-prolonging Concave Side naturally delivers greater savings today than ever before.

GATES VULCO ROPE DRIVES

Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U. S. and 71 Foreign Countries

THE GATES RUBBER COMPANY
DENVER, U.S.A.
"The World's Largest Makers of V-Belts"

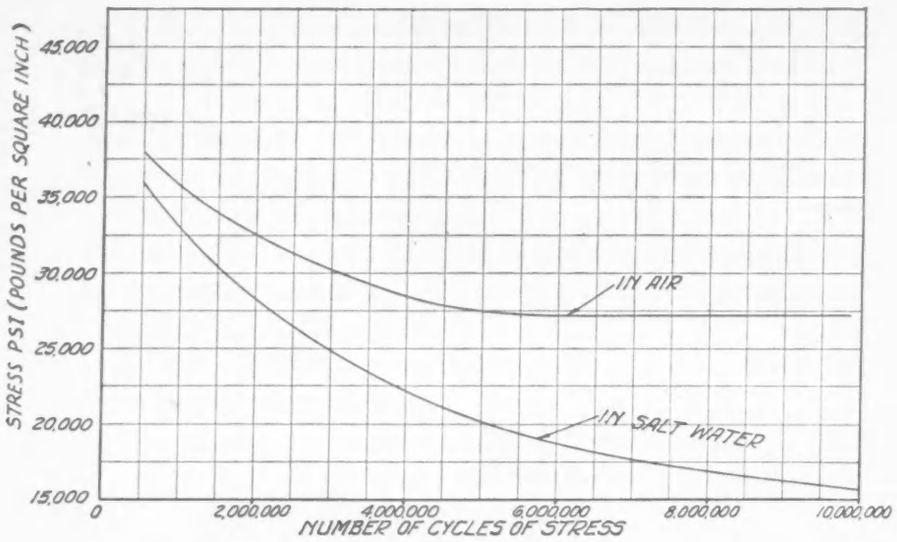


FIGURE 23
Typical fatigue curves of a steel tested in air, and in salt water.

it is easy to imagine that some of them will be of the right shape—and running in the right direction—to substitute for a transverse mechanical scratch.

To realize that corrosion alone will weaken steel in resistance to bending, we only need recall how much easier it is to snap off a rusty steel nail, sticking in a board, than a bright new one; or how much easier it is to break rusty wire, by bending it back and forth, than new wire. Both of these are good illustrations of every-day corrosion fatigue. Another common example is the cracking through of rusty sheets, being torn from a building, as compared with the surprising ductility of new sheet steel.

It is quite easy to understand all of these failures, because they involve the theories of causing fracture where the metal has been stressed violently, far beyond the yield point. But what surprises the average user of drill pipe are the failures which occur when he knows full well (and correctly) that the metal is *not* being stressed to what ordinarily would be a dangerous degree. This is where we must leave "common-sense" theory and go into the realm of "pure" theory. We must go back again to the "S-N" (stress vs. number of cycles) curves. This time two curves are used; as an illustration, see Figure 23. In one curve the specimen is bent back and forth in a non-corrosive medium (air), and the other curve shows what happens when the specimen is surrounded by a mildly corrosive liquid (like salt water).

As before, these curves show (approximately) how many stress reversals are required at any given stress to cause fracture; but they also show graphically how very much lower the stress need be, with a given number of stress reversals, to cause fracture in salt water as compared with air. And this is what is called "corrosion fatigue."

Thus, the upper curve shows that a given piece of steel, when bent back and forth in air with a maximum stress of 32,500 pounds per square inch, will fail at 2,000,000 cycles; whereas the failure in salt water, under otherwise similar conditions, will occur at only 1,100,000 cycles. Or, to put it even more strikingly, the "endurance limit" of this steel, in air, is 27,000 pounds per square inch—meaning that ten million, or twenty million, or any number of stress reversals, never will make this steel fail, whereas salt water (just a mildly corrosive medium) will cause fracture at only 2,300,000 cycles at this same stress.

This means that drill pipe mildly stressed in a non-corrosive mud might drill almost indefinitely, whereas in salt water it might start to fail in its third or fourth well—all of which is quite a mystery until the significance of the foregoing curves is understood correctly. It means, too, that the "endurance limit" has been lowered very definitely, and in order to obtain the same life the drill pipe must be stressed less. Or, the operator must be resigned to much less life from his pipe in corrosive drilling muds than in non-corrosive ones.

To illustrate this rapid decrease in life, a number of bending fatigue tests recently were made on small samples of drill pipe, all cut from the same pipe and all stressed to the same degree, about 31,500 pounds per square inch. The only variation in conditions was the medium in which the specimens were stressed: air or distilled water as non-corrosive media, salt water as mildly corrosive, magnesium chloride as a definitely corrosive solution, and dilute hydrochloric acid as very corrosive.

The results of this series of tests are as follows:

No. of of Tests	Average Max. Stress (PSI)	Medium	No. of Cycles to Failure
14	31,500	Non-corrosive	2,200,000
5	31,500	Mildly corrosive	1,430,000
6	31,500	Corrosive	860,000
6	31,500	Very corrosive	182,000

Although run quite carefully, the foregoing tests were not considered as a scientific study of the *exact* effect of the various media, and no attempt was made to duplicate field conditions. The

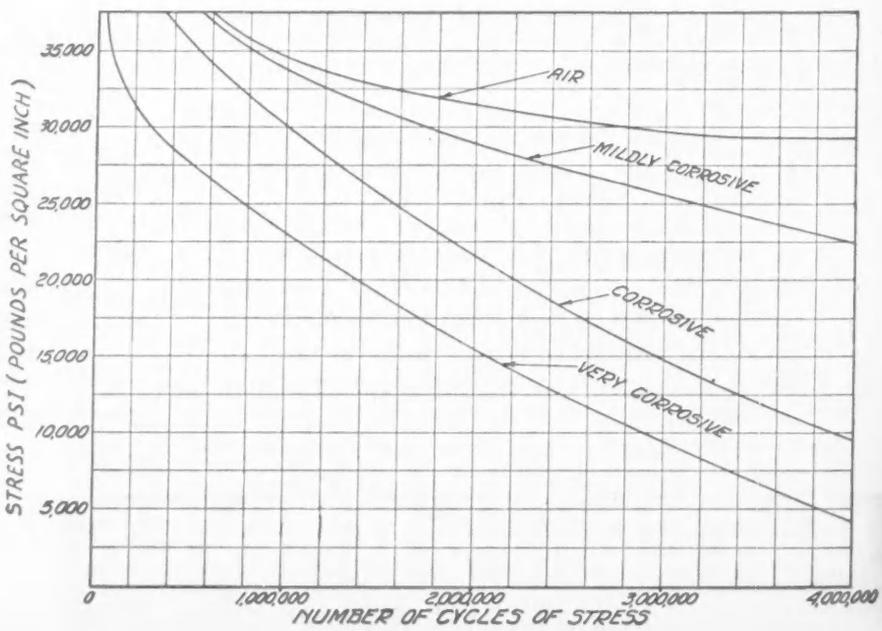
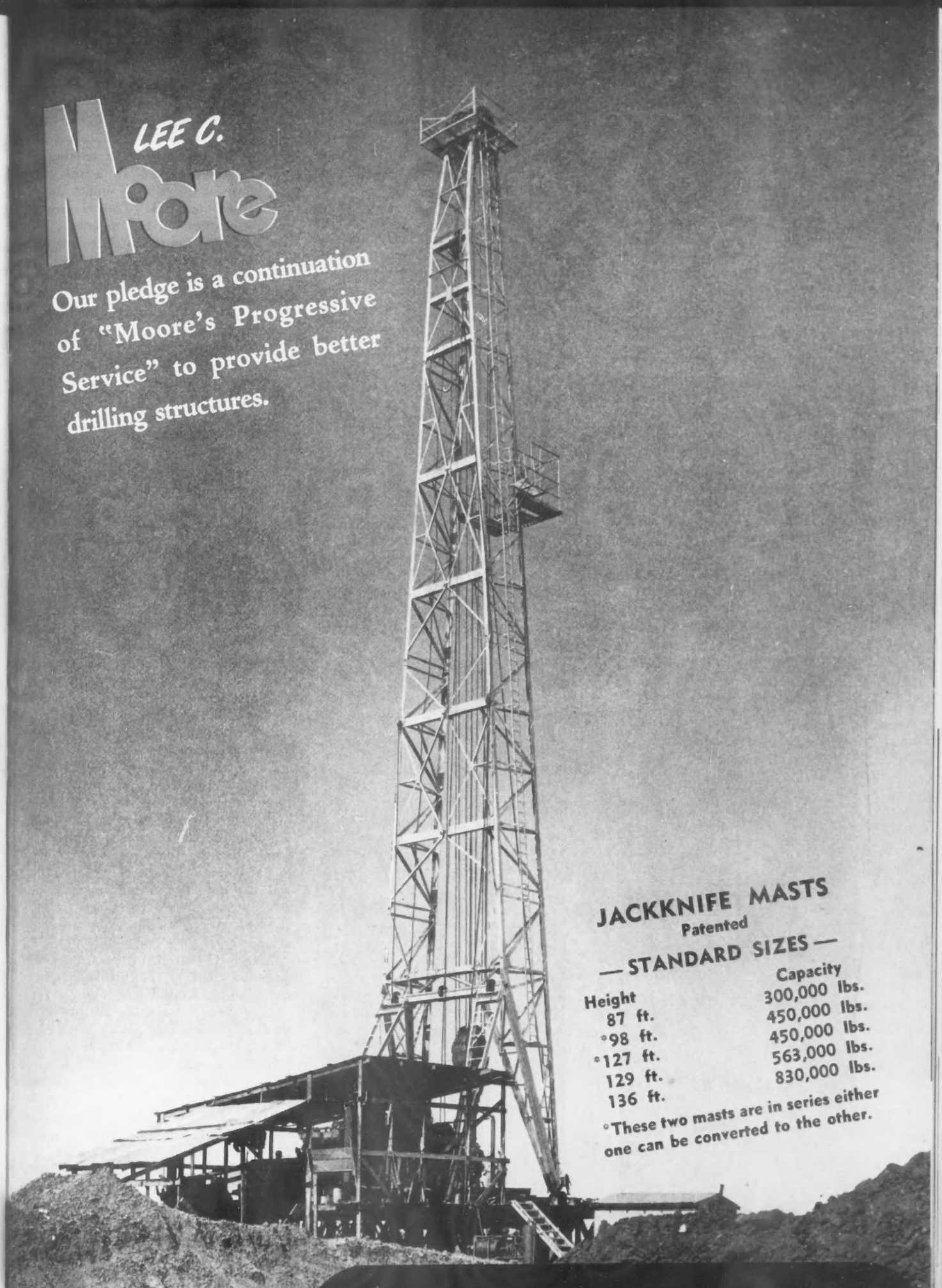


FIGURE 24
Typical "S-N" curves for steel in various media.


LEE C.
Moore
Our pledge is a continuation of "Moore's Progressive Service" to provide better drilling structures.
JACKKNIFE MASTS
Patented
— STANDARD SIZES —
Height
87 ft.
*98 ft.
*127 ft.
129 ft.
136 ft.
Capacity
300,000 lbs.
450,000 lbs.
450,000 lbs.
563,000 lbs.
830,000 lbs.
*These two masts are in series either one can be converted to the other.
LEE C. MOORE CORPORATION
TULSA • DALLAS • HOUSTON • MIDLAND • SHREVEPORT • WICHITA • CENTRALIA • PITTSBURGH
Export Office — 50 Church Street, New York 7, N. Y.

aim was to treat each specimen exactly alike, except for the medium in which it was stressed, and to show how very remarkably the life of the specimen is decreased as the corrosiveness of the fluid is increased.

If these tests had been completed, through various stresses, the resulting "S-N" curves might look something as indicated in Figure 24.

To put the foregoing figures into imaginary footage figures they could be divided by 50, thus:

Medium	Hole Drilled Before Failure (Feet)
Non-corrosive	44,000
Mildly corrosive	28,600
Definitely corrosive	17,200
Very corrosive	3,600

Although imaginary, these figures are not far from actual practice when 4½-inch pipe is used. Thus, in non-corrosive rock-bit territories such as North Louisiana, East Texas, parts of Oklahoma, parts of California, Wyoming, Alberta (Canada), etc., where the digging is considered pretty hard, it is quite common to drill forty to fifty thousand feet of hole before drill pipe failures start to occur. And, at the other end of the scale, there are numerous cases of failures which occur in the first well, at less than 4000 feet. This would be in very corrosive "hot spots," with hydrogen sulfide present, such as in parts of West Texas, northern Oklahoma, many parts of Kansas, and southern Arkansas.

Mildly corrosive territories would cover most of Oklahoma, North Central Texas, West Texas, New Mexico, and a few parts of California. Definitely corrosive would be represented best by most of Kansas, except for the few spots that would fall in the very corrosive class.

In the light of greatly increased experience with corrosion fatigue the above paragraph should be revised to show that the Permian Basin of West Texas and New Mexico is the predominantly "very corrosive" area of the U. S. "Definitely corrosive" now would describe North Central Texas as well as much of Kansas and "mildly corrosive" would still embrace most of Oklahoma and a few parts of California. All other areas in the U. S. and in most foreign countries can be classed as non-corrosive, with isolated exceptions (Egypt, for example).

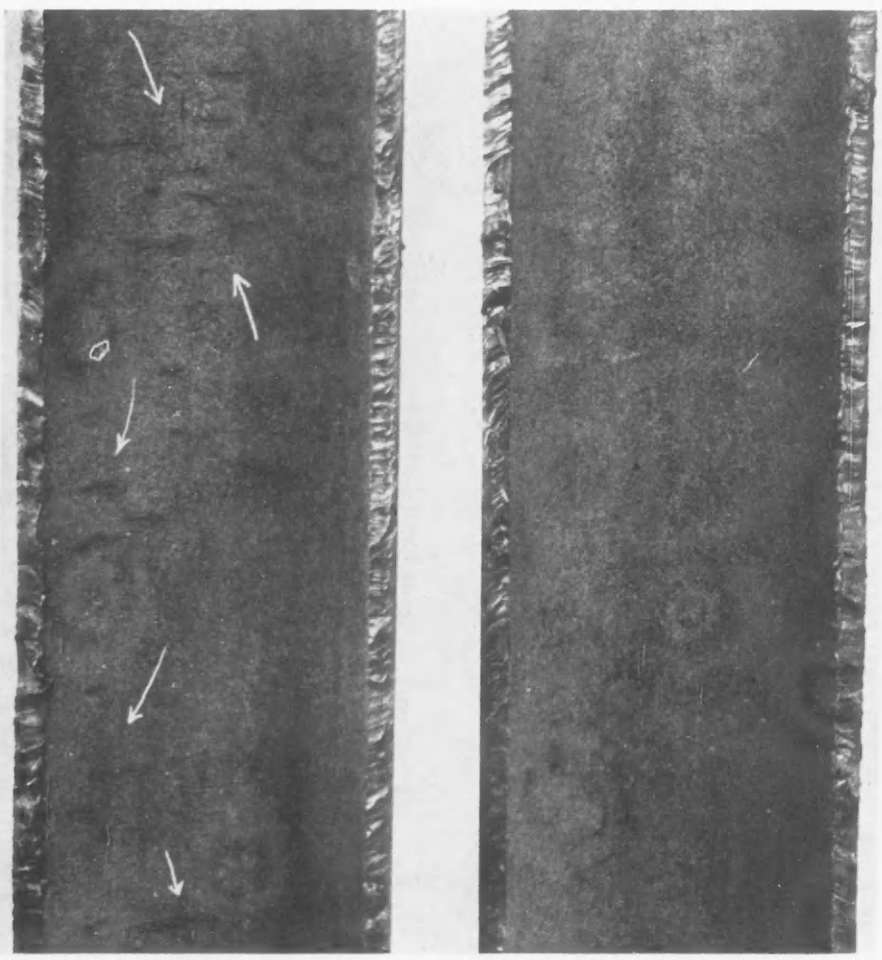


FIGURE 25
Effect of corrosion from salts in bottom section of racked drill pipe

In the actual tests just described, the specimens failed from either *external* or *internal* corrosion pits. In actual drilling, however, the failures almost always start from the inside. This is because any pit starting on the outside is polished off almost immediately by the rubbing of the pipe against the sides of the hole, so that only an inside pit ever can become deep enough to act as a notch (stress-concentration point). In pure fatigue, the fatigue cracks usually start from the outside, because the stress is highest at that point. Also, cracks from pure fatigue start near a tool joint, where the bending stress is highest, and to some extent the tool joint protects them from being polished off against the formation.

Going now a little further into pure theory, it must be understood first of all that there is no true endurance limit for steels subjected to corrosion. Under non-corrosive conditions the "S-N" curve for any given steel gradually flattens out into a straight line (at the endurance-limit point); and if stressed at or below this point, the number of stress reversals may be carried on indefinitely without ever causing failure.

Under corrosive conditions, however, the curve never becomes flat. In other words, there is no stress low enough which would permit of indefinite life of the specimen. This is illustrated clearly in Figure 23.

The reason is simple. The corrosion continually is adding nicks and notches to the surface of the steel so that, no matter how low the stress, there will be formed sooner or later a deep enough notch that the specimen will fail. Or, to put it another way, corrosion finally will eat its way entirely through the steel, even if the specimen is not stressed at all, as illustrated in Figure 23.

Therefore, there being no true endurance-limit figure, the life of steel in corrosive media must be expressed in units giving the number of stress reversals. Thus, a steel which has an endurance limit of, say, 27,000 pounds per square inch in air might be said to have a limit in salt water of 20,000 pounds per square inch at 5,000,000 cycles, or 16,000 pounds per square inch at 10,000,000 cycles, or only 10,000 pounds per square inch at 20,000,000 cycles.

One practical conclusion from this is that drill pipe can deteriorate in storage, especially if laid down while still wet with corrosive drilling fluid. Even when seemingly dry, there will be enough condensed water from the air, or from rain, to keep the inside moist and allow corrosion to proceed. This is well illus-

Thermoid Slush Pump Suction Hose and Discharge Hose Units *for Severe Service*

THE Thermoid line of Suction Hose and Discharge Hose units is recommended for severe service with drilling fluid containing sand, grit and other abrasive materials.

Slush Pump Suction Hose consists of an abrasive resisting tube with round wire reinforcement, fabric plies and tough wear resisting cover and is furnished in sizes from 4-inch to 12-inch I.D.

Discharge Hose Units are made with a Neoprene tube which is resistant to oil as well as abrasives. It is reinforced with braided steel wire as well as fabric plies and has a tough weather-resistant Neoprene cover. These units are furnished in 2½, 3 and 3½-inch sizes with Full-Flow Built-In Couplings.

The giant wire in both the Suction Hose and Discharge Hose Units is floated in a double cushion of live rubber, assuring extreme flexibility required for pump pulsations.

Another important item in the Thermoid line is Powerflex Rotary Hose. It, too, is designed to withstand the punishment inflicted by pulsation. Its long service life makes it the most economical buy per foot of hole.

. . . in stock at the nearest "Oilwell" store

The Thermoid Line Includes:
ROTARY HOSE · SLUSH PUMP HOSE · FLEXIBLE DISCHARGE UNIT HOSE · PRODUCTION AND REFINERY HOSE OF ALL TYPES · V-BELTS AND DRIVES · OIL COUNTRY BELTING · STUFFING BOX RINGS · WOVEN OIL FIELD BRAKE LINING

OIL WELL SUPPLY COMPANY

Branches Serving All Oil Fields

Executive Office—Dallas, Texas
Export Division Office—
30 Rockefeller Plaza
New York 20, N. Y.

Division Offices—Casper, Wyoming
Columbus, Ohio . . . Dallas, Texas
Houston, Texas . . . Tulsa, Oklahoma
Los Angeles, California

OIL WELL SUPPLY COMPANY · USS OILWELL · UNITED STATES STEEL

UNITED STATES STEEL

"OILWELL"

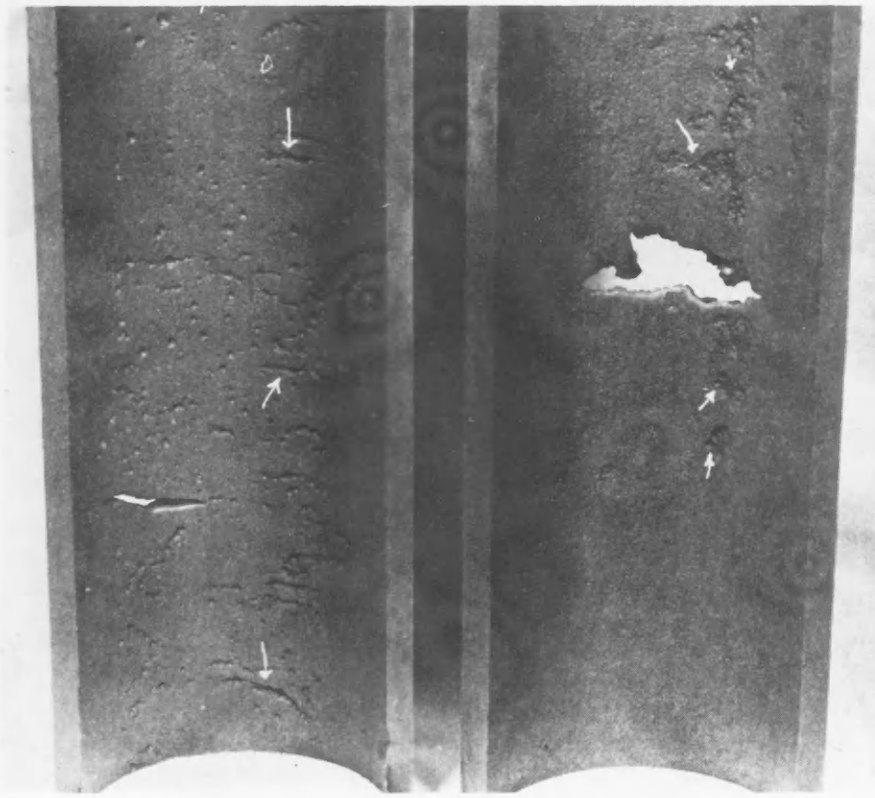


FIGURE 26
Typical corrosion fatigue, from West Texas

An obvious remedy for this would seem to be the removal of the scale, by pickling or shot-blasting, at the time the pipe is made. Experiments along this line already are being carried out, particularly in California, and references to this subject are given in the bibliography of this paper.[1] Unfortunately, no well conditions in California are nearly so corrosive as in many areas of the Mid-Continent, and it is rather doubtful whether the beneficial effects indicated in the California experiments will be obtained in truly corrosive areas.

Another rather obscure factor in corrosion fatigue is the effect of stress on the relative electro-potential of steel. Stressed metal becomes electro-negative to unstressed metal and, here again, a minute electric current is set up in the presence of a salt solution and, again, the pitting is speeded up over that of purely chemical action.

Thus the whole vicious cycle of corrosion fatigue is illustrated in Figure 25, which shows very definitely a longitudinal area of corrosion (and cracks), at what was the bottom of the length as it lay on a rack, whereas the top half of the specimen shows very little corrosion and *no* cracks at all.

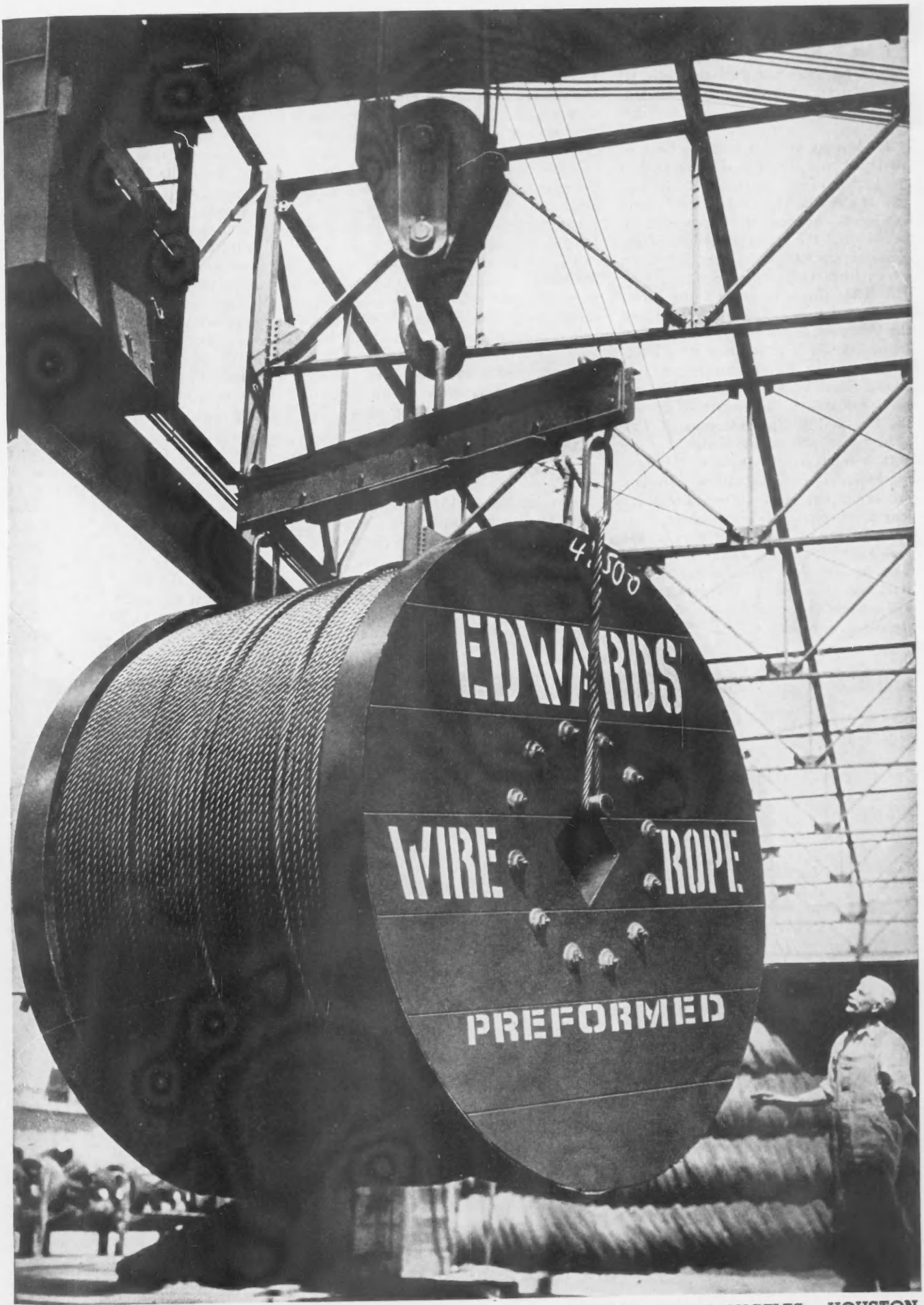
[1] Figures refer to Bibliography in Part 4.

Obviously it would be worthwhile to flush out pipe which is to be stored. In fact, it even might be worthwhile to flush out each stand every time it is brought up out of the hole, if there were some practical way to do this.

Aside from the mechanical notch effect of a corrosion pit, produced by purely chemical action, there are other factors involved. These merely will be mentioned, because currently they are being studied practically in an effort to improve the life of drill pipe.

One factor is the electrogalvanic effect of mill scale found on any hot-rolled product. In contact with steel, and in the presence of even a very dilute salt solution, a battery effect is set up in which a minute electric current flows from the scale to the steel, from the steel into the fluid, and from the fluid back into the scale. This, of course, appreciably speeds up the purely chemical attack of the fluid. When direct current leaves steel, it carries iron with it, as ions, at the rate of 20 pounds per ampere per year.

FIGURE 27
Typical corrosion fatigue, from Kansas



E. H. EDWARDS COMPANY — SEATTLE • PORTLAND • SAN FRANCISCO • LOS ANGELES • HOUSTON

rosion fatigue might be thought of as follows:

1. The chemical effect produces a minute pit. Also the electrogalvanic effect between scale, steel, and fluid produces another pit, or deepens the first one.

2. Then, as the pipe metal is bent, or stretched, the stress is concentrated at the bottom of the pit, just as at the bottom of a notch. This creates a difference in potential between the highly stressed bottom and the unstressed edges of the pit, and an electric current is set up which further deepens the pit.

3. Then, in a deeper pit the stress concentration becomes still greater and the electro-potential difference is greater, and the current becomes more effective in making the pit still deeper. And so on. Small wonder, then, that corrosion plus fatigue can reduce so greatly the life of drill pipe as compared with what either factor alone could do.

It is interesting to note that fatigue cracks from corrosion fatigue can, and do, occur almost anywhere along the length of pipe, whereas failure from pure fatigue is concentrated near the tool joints (as noted under item 6-a). This is natural, because corrosion can start almost anywhere, but pure fatigue will concentrate only where the bending stresses are greatest.

Also of interest is the fact that in cases of failure where the lengths have been run on with so much compression as actually to bend them permanently, the worst cracks are on the convex side of the bow. This might mean that the tension side of the bow is most susceptible to corrosion fatigue; or it might indicate that the convex side is where the pipe had worn thin by rubbing hard against the hole, leaving less thickness for the fatigue cracks to penetrate. Not too much is known about this point.

Figures 26 and 27 illustrate typical examples of corrosion fatigue taken from drill pipe operating in widely different areas. One is from West Texas and one from Kansas. Note that they look considerably alike. Of course, not all specimens have as many actual cracks started as those shown, but all cases of corrosion fatigue show the same general characteristics.

Another point in common, regardless of the locality, is illustrated in Figure 28. These are strip pulling tests cut from a sample of drill pipe which had failed from corrosion fatigue. Note the very great number of transverse cracks which opened up as soon as the metal was stretched in the pulling machine. They were mostly invisible to the eye, before pulling, and their existence is proof positive that corrosion fatigue was at work. Pulling test samples of pipe failing from any other cause, i.e., pure fatigue, notch fatigue, etc., never show these little transverse cracks, except possibly in the immediate vicinity of the failure. Hence, the laboratory can never be mistaken if corrosion fatigue is the cause of the trouble.

A simple field test for corrosion fatigue is to burn out a longitudinal strip, about 2 inches wide and 18 inches long, and bend it backward in a vise so as to stretch the internal surface — then examine for transverse cracks, disregarding cracks at the corners, these being due to the embrittling effect of the cutting torch. A milled-out strip, of course, would be better, as illustrated in Figure 29.

So far there is no accepted method for preventing corrosion fatigue—although, as stated, practical study of the problem currently is being undertaken. Removing scale from the inside might be the first step, but is probably only a short step. The real solution would seem to be coating the inside of the pipe so as to prevent corrosion entirely. However, the problem of finding a coating which could be applied readily, without

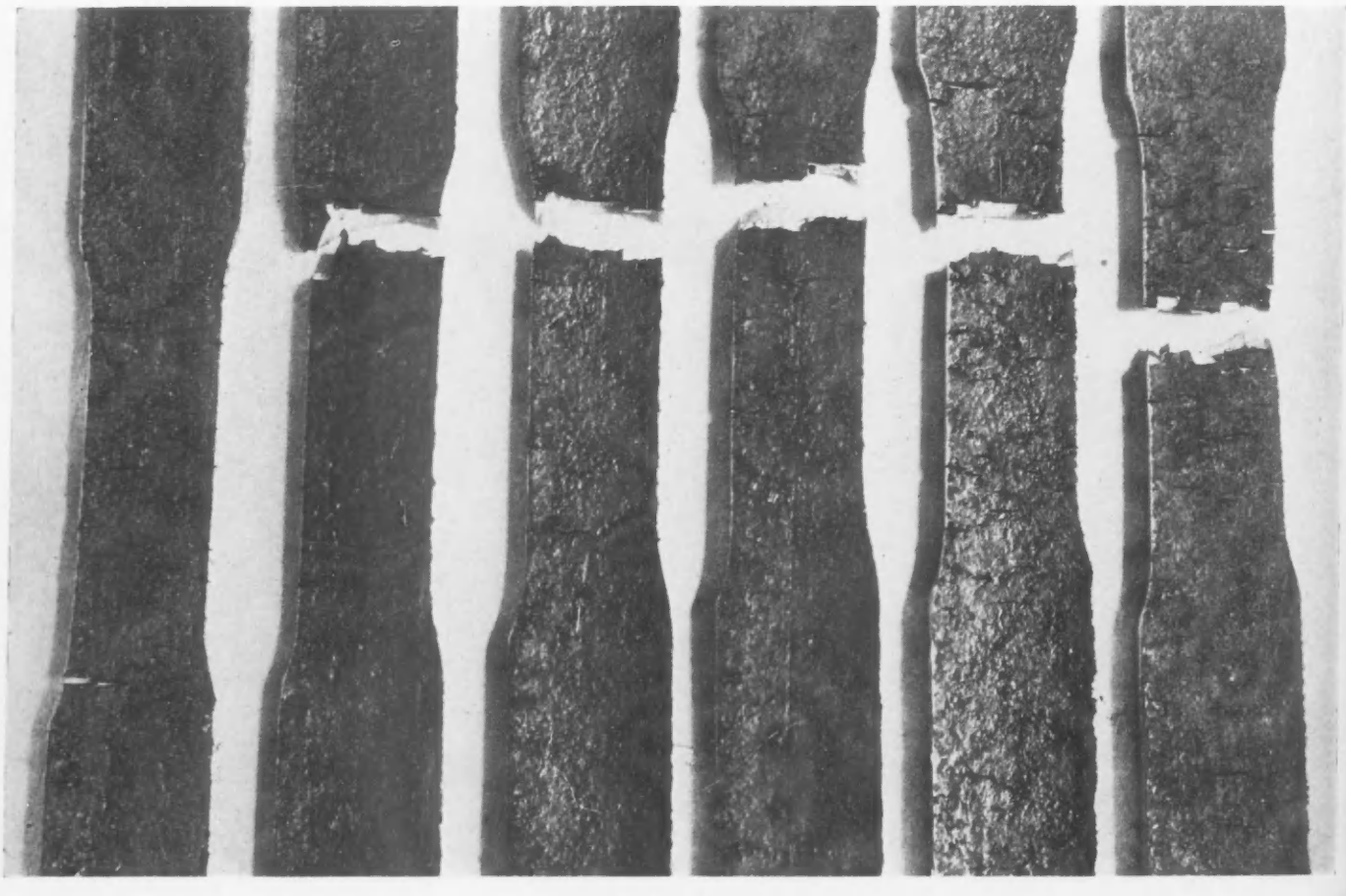
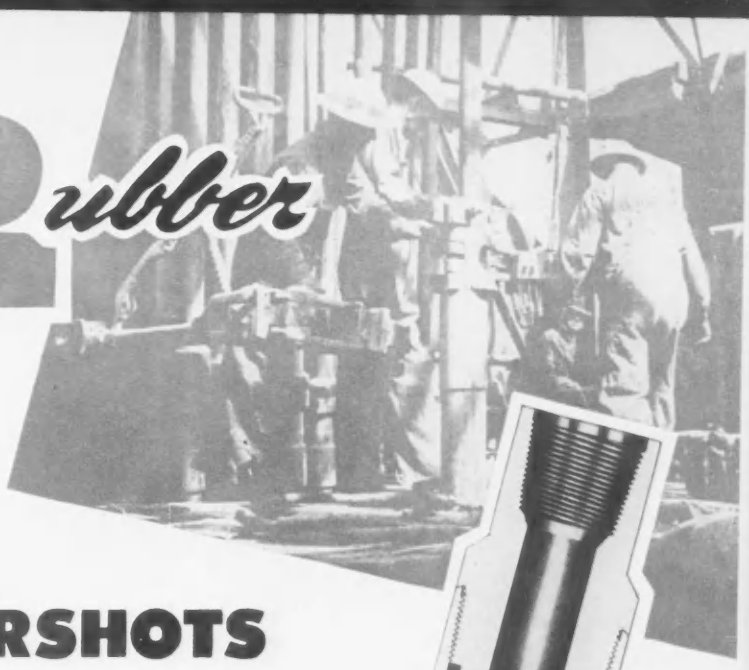


FIGURE 28
Opening of corrosion fatigue cracks under tension load

Murray Rubber



GOES FISHING

WITH HOMCO
TOP LOADING OVERSHOTS

Fishing tools made by Houston Oilfield Material Company, Houston, Texas, have long been recognized for their dependable performance. Naturally, Murray considers it a fine recommendation that this leading manufacturer of fishing tools has entrusted us with the responsibility of producing the molded rubber components of Homco fishing tools.

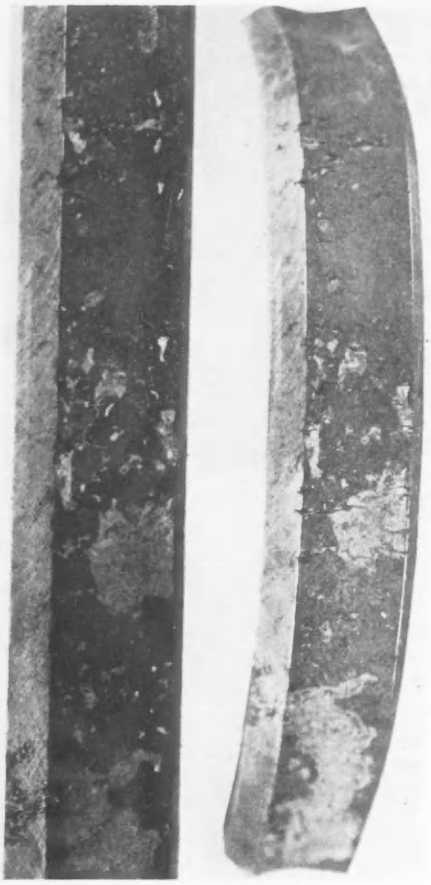
Murray's years of specialized experience in producing natural rubber and synthetic oil-resistant rubber parts for oil tools is available to any manufacturer. Our experienced oil field equipment designing engineers will gladly assist in working out a prompt and economical solution to your problem.

The Murray Tool and Mold Division offers the facilities of its modern machine shop to relieve Murray customers of the responsibility of designing and producing molds, dies, metal inserts, and other precision parts required for a complete rubber molding operation.

MURRAY RUBBER COMPANY

HOUSTON, TEXAS

The Homco Top Loading Overshot, shown in cross-section above, is designed for simplicity and ease of assembly.



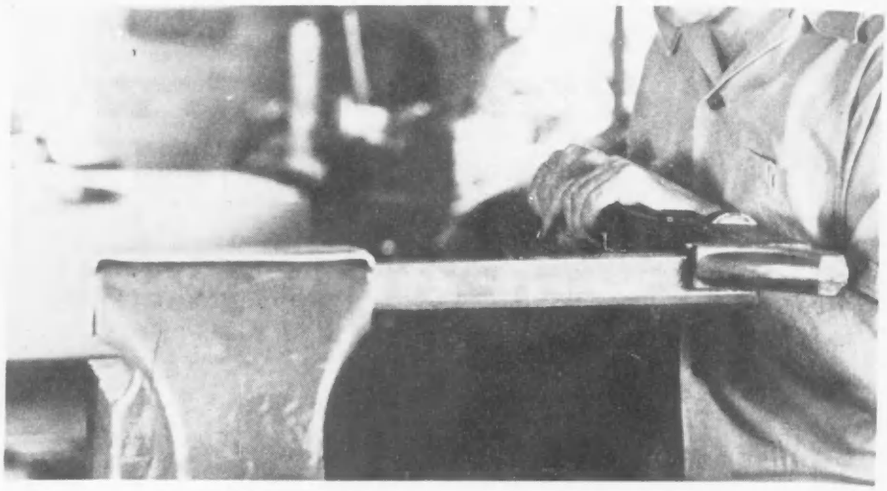


FIGURE 29
Field bending tests

pin holes, absolutely impervious to all drilling fluids ordinarily encountered, and with sufficient ductility to withstand tension, bending, hammering, and erosion by the mud stream, is not an easy task. The same problem has long been studied on sucker rods, with none too great success.

About a year after the original presentation of this paper one pipe manufacturer began preliminary experiments, in the field, with internally shot-blasted and with shot-blasted and coated drill pipe.[16] The results were so encouraging that, in 1945, this company began commercial production of internally coated drill pipe at its plant and has kept these facilities in full operation ever since.

Briefly, the process consists in grit-blasting the interior surface to remove all mill scale. Then the lengths are given four coats of a phenolic base, thermal setting plastic, each coat being baked after each application and given a final polymerizing bake.

So far there is still only one pipe company coating drill pipe at the mill, but there are several independent coating firms doing shop or field application. One of them uses a thermal setting plastic and others use air drying types, all of which are giving excellent results.

The coatings remain in place remarkably well, but do disappear—whether by solution or erosion is not known. The significant fact is that corrosion fatigue cracks do not seem to develop even some time after the coating is 100 percent gone, due no doubt to the absence of mill scale on the metal surface exposed by the disappearance of the coating.

In any case, experience to date indicates that internal plastic coating of drill pipe will lengthen its life in severe corrosion fatigue areas some four to five times that of untreated pipe. Of two comparative 4½-inch test strings, both still operating as "salt strings" in West Texas, the coated string has drilled more than 50,000 feet of hole with *no* corrosion fatigue failures while the other one, unprocessed, has had twelve failures in only 35,000 feet of drilling. The first failure occurred in the very first well.

Galvanizing the inside of drill pipe might seem like a logical step, and has been tried in California, but without success, as it did not appear to be sufficiently permanent (Veyne Mason).[1] It might even be harmful, because the endurance limit would tend to be reduced by the brittle iron-zinc alloy layer in which cracks could form that would propagate through the steel. This difficulty, however, could be overcome by electro-depositing the zinc, but there are as yet no recorded experiments along this line.

Alloy steels, to prevent corrosion fatigue, are also quite disappointing. No doubt some truly corrosion-resistant alloys, such as the stainless steels or high-chromium alloys, would make good drill pipe, but their cost would be prohibitive.

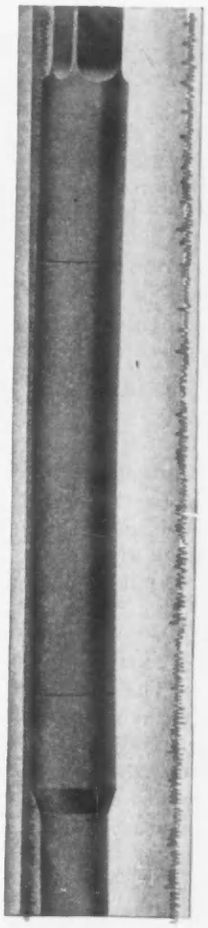
The only present remedy for too rapid failure from corrosion fatigue is to lower the mechanical stresses to such a point that the stress factor becomes a minimum. When bending is the critical factor, enough drill-collar weight must be run on the bottom of the drill pipe to insure that the pipe is never in compression. That this is truly effective is borne out by a comparison of drilling practice in corrosive "hot spots." Those who run long, heavy drill collars above the bit *do not* have premature failures. Those who run the drill pipe in compression are the ones whose pipe starts breaking early in its life. This sometimes occurs even in the very first well.

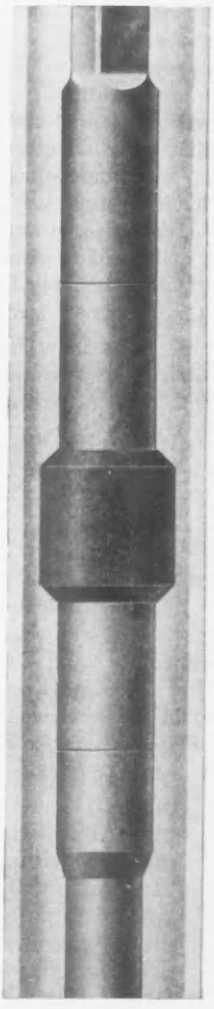
In 1941 the use of long drill collar strings was the "only . . . remedy for too rapid failure from corrosion fatigue." Today it is still the largest single factor. Whereas a nine collar string was once considered long, there now are being run as many as 18 and even up to 24 collars above the bit.

When tension is the stress factor, as in wells 10,000 feet and deeper, the stress can be lowered by using tapered drill pipe strings, with heavier-weight pipe on the top, or with both larger outside diameter and heavier weight. For-

PATTERSON-BALLAGH
OIL VIEWS
Kelly Wears Through
Surface Casing in Two Days
Shreveport, La.—Feb. 12—This operator moved his rig, spudded in, and set the surface casing. He knew he needed a Kelly Sub equipped with a Patterson-Ballagh Kelly Sub Stabilizer to do a good job of the drilling. He ordered a new sub recessed to mount a Stabilizer, but could not secure immediate delivery, so he started drilling with the old sub and no rubber protection.
In two days, the surface casing was worn through from the constant beating by the Kelly. The operator lost two days in repairing the separated surface casing. This operation lost him money three ways—(1)lost hole he would have drilled (2) lost pay of the men during down time (3) lost the cost of bringing in cement and replacing casing.

CASE HISTORY 801





Rough DRILLING

AND WORN SURFACE CASING

or Smooth DRILLING

WITH A PATTERSON-BALLAGH KELLY SUB STABILIZER

Wearing out surface casing in two days just because a Kelly Sub equipped with a Patterson-Ballagh Sub Stabilizer was not used sounds impossible, but our records show it did happen.

We say that worn surface casing like that may be avoided. Let rubber take the beating, not the casing.

Wobble in the Kelly could come from many causes such as a bent Kelly, the table not centered over casing, or a misaligned crown block. Both operators drilling their own wells and drilling contractors can save time and money minimizing the effect or damage caused by wobble in the Kelly. Install a Patterson-Ballagh Kelly Sub Stabilizer on your Kelly Sub today!

PROTECTION PROVEN

Specify

PATTERSON-BALLAGH

DIVISION OF BYRON JACKSON CO.

KELLY SUB STABILIZERS

Main Office:
1900 E. 65th St. Los Angeles, Calif. ★ 6247 Navigation Bldg. Houston 11, Texas ★ 808 Graybar Bldg. New York 17, N.Y. ★ 330 Russ Bldg. San Francisco, Calif.

T.I.P.S.A., Santiago Del Estero 286; Buenos Aires, Argentina; H. F. Towler, 9 Cavendish Square, London, WI, England.

tunately, in most deep areas, corrosion is not a large factor.

It is no longer believed that tension is ever a factor in corrosion fatigue. Nor is compression, as such, but you cannot have compression without bending and the large number of reversed bending stresses to which the pipe is subjected while held in a bent or bowed contour is the truly inimical factor in the problem.

Incidentally, it is not even believed that torsion is ever a factor in corrosion fatigue nor in any other types of drill pipe failure, *except* as noted under 1. True Twistoffs.

Another possible remedy for corrosion fatigue would be chemical treatment of the drilling fluid. There is no doubt that any given fluid could be treated, in a laboratory, so as to render it absolutely non-corrosive, but to do this commercially at a drilling rig is a big problem. It would require very special mud-treating pits and 24-hour supervision by mud chemists. The trouble is that the fluid often is changing rapidly, in composition, especially while drilling through sections of salt, anhydrite, etc. Also, in many corrosive areas, the evil-smelling gas known as hydrogen sulfide is a big factor, and its content is extremely variable.

It is now believed that hydrogen sulphide is only *very rarely* a factor in corrosion fatigue. Just plain, ordinary salt seems to be by far the worst offender.

The quite indefinite conclusions of the API Subcommittee on Corrosion Fatigue of Drill Pipe are the best proof of all that chemical treatment of drilling fluid is still very much in the experimental stage. However, the committee's findings are of interest, and should be reviewed by all who are studying this phase of the problem.[15]

In 1945 the Philadelphia firm of W. H. and L. D. Betz (water corrosion consultants) made a preliminary study of "Inhibition of Drill Pipe Corrosion"[17] and suggested sodium chromate additions to drilling muds in the order of 1000 to 10,000 parts per million. This led to field trials, using 2000 to 3000 p.p.m., with immediate and surprisingly satisfactory results.

Unfortunately, sodium chromate is a scarce item and at times almost unobtainable. Nevertheless, the cost is not excessive and where it has been employed throughout the life of a drill string an increase in life of three to four times that of drill pipe when the mud is not treated is indicated.

The API Subcommittee on Corrosion Fatigue of Drill Pipe obtained negative results in their study of sodium chromate, after its use had been suggested some 10 or 15 years ago. Muds, in those days, were usually on the acid side, below pH 7, and possibly the chromate was reduced out of solution. Today muds often are given caustic soda or other alkali additions and sodium chromate can be kept to required concentration with no difficulty, as long as circulation losses are not high. The "24-hour supervision by mud chemists" proved to be a needless fear and simple titration checks every few days is all that is necessary.

As these revisions are being written a laboratory and field experiment using sodium nitrite as an inhibitor is showing interesting results. This would bear further study as sodium nitrite is much more readily obtainable, and much less expensive, than sodium chromate. The nitrite had been suggested by W. H. and L. D. Betz in their original report, but had not been tried out in drilling muds at that time.

As to why corrosion fatigue is so much more prevalent now than a few years ago, there seems to be a very simple answer. The drill pipe is being run under definitely higher stresses.

At one time, particularly in areas where corrosion is a factor, the predominant drill pipe size was 6⅝-inch, or occasionally 5-9/16-inch. Now it is almost exclusively 4½-inch and 3½-inch and with holes being drilled which, although smaller, are not proportionately so. So naturally, even with reasonable care, the smaller drill pipe must surely be subjected to much higher compression, bending, and tension stresses. Then, too, wells are being drilled faster than a few years ago, mainly because of well-understood competitive conditions—and this again raises the stress factors. Small wonder, then, that drilling seems to have run into a new wave of trouble.

Since the only truly harmful stress in drill pipe, under normal drilling conditions, is that of bending, it is no longer believed that the use of smaller drill pipe, for drilling a given size hole, is much of a factor. In fact, it is being demonstrated in West Texas that *less* corrosion fatigue trouble is encountered with 3½-inch O. D. pipe than with 4½-inch, or with 4½-inch than 5½-inch (formerly 5 9/16 inch).

The reason for this is that, for a given degree of bending, the bending stresses in a tubular section become less as the diameter becomes less. Therefore, as long as sufficient mud circulation can be maintained, it is recommended that small O.D. drill pipe be used in corrosive areas.

As stated previously, nether tension nor torsion are factors involved in corrosion fatigue.

6-d. Hydrogen or Hydrogen-Sulfide Embrittlement

In corrosion fatigue, the cause of failure is the notch effect of pits caused by corrosion, and there is no intimation that the steel under the pits is any less resistant to fatigue than elsewhere. As emphasized before, the pit is merely a stress-concentration point, and has no more or less effect than a mechanically produced pit or notch of exactly the same size and shape.

There are still other corrosion factors, however, in which the steel itself is altered—at least temporarily—and are suspected of being the cause of certain astonishingly rapid drill pipe failures. They are called "hydrogen embrittlement" and "hydrogen-sulfide embrittlement." Their effects have been studied on sucker rods as well as on drill pipe, but nothing very definite ever has been learned, principally because the effect is only temporary.

Briefly, steel can be embrittled by adsorption of gas. It is as though the gas, hydrogen for example, becomes alloyed with the iron crystals, thus forming a very brittle alloy. It apparently occurs only when drill pipe is in exceptionally corrosive fluids, actually weak acids, but the theories involved need not be discussed here. Suffice it to say that, when removed from the embrittling agent, the steel gradually resumes its normal condition by giving off the gas which had been adsorbed. Heat, incidentally, hastens this process.

Whether much breakage truly can be attributed to hydrogen or hydrogen-sulfide embrittlement is a moot question, but it is interesting to note that for many years operators have believed that allowing drill pipe or sucker rods to "rest" in the open air decreases the tendency to breakage in corrosive areas. This is quite logical if we agree to the embrittlement theory by adsorption of gas.

(To be continued next month)

WHAT DO YOU SEE HERE?

NOTHING! ... AND NEITHER DOES THE DRILLING CREW!

What would happen if your rig lighting plant failed while you were running casing? The results could be disastrous if the casing sticks. Can you afford to gamble on lighting plants when you can get a dependable Stewart & Stevenson factory-built and engineered lighting plant backed by our complete, twenty-four-hour-a-day maintenance service?

We manufacture a complete line of rig lighting plants to fit your needs. You have a choice of the simple rig lighting plant or the auxiliary combination unit with rig lighting plant, electric welder, accessory drive and air compressor unit. Both are factory-engineered and factory-built and both are offered with either GM Diesel Engines or Continental Red Seal Engines.

HOW STEWART & STEVENSON SERVICES GUARANTEE MORE DEPENDABLE LIGHTING

24-hour service at strategic locations means that you are always close to a Stewart & Stevenson engine expert.

Largest stock of parts anywhere for GM Diesels and Red Seal Engines plus a fast delivery service means minimum shut-down time for engine repairs.

You're buying more than just a rig lighting plant when you buy from Stewart & Stevenson — you're buying an insurance policy for dependable service. See your Stewart & Stevenson representative today.

STEWART & STEVENSON SERVICES

STEWART & STEVENSON SERVICES

HOUSTON — 4516 Harrisburg Blvd. Phone W. 6-9691

McALLEN — 19 East Highway Phone 1760

DALLAS — 4801 Lemmon Ave. Phone L. 6-6649

WICHITA FALLS — P. O. Box 1415 Phone 2-3319

CORPUS CHRISTI — 643 N. Port Ave. Phone 8252

GREGGTON — P. O. Box 546 Phone 2007

SALES REPRESENTATIVES

BEAUMONT Phone 2-9619

LIVINGSTON Phone 429-G

LONGVIEW Phone 3292-R

LAREDO Phone 1513-R

GM DIESEL POWER — Simplicity in Motion — Continental Motors — America's Standard

PARTS • SERVICE Anytime Anywhere

DISTRIBUTORS OF: General Motors Diesel Engines • Continental Red Seal Gas Engines • Packard Marine Engines • Gardner-Denver Pumps

FABRICATORS OF: Electric Power Units • Electric Control Equipment • Portable Pumping Units • Truck Bodies, Etc.

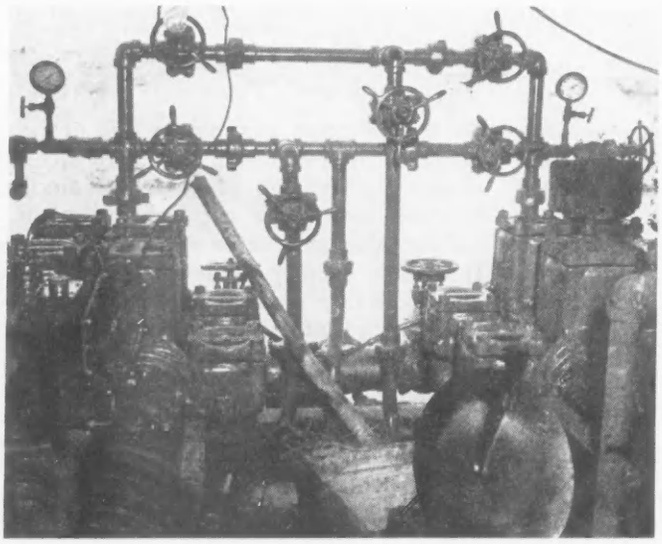
THE NATION'S LARGEST DISTRIBUTORS OF GM DIESEL ENGINES

DRILLING HINTS

How to do it!

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

HOW TO—Control Feed Water Pumps by Installing Discharge Manifold



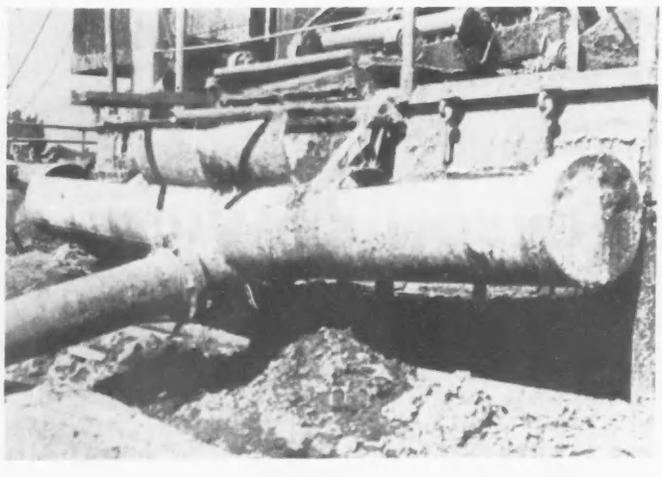
The control of both feed water pumps has been efficiently handled by the installation of a discharge manifold illustrated. Centralized piping and location of control valves in this manner has added convenience for the fireman as well as provided a unitized installation which facilitates setting up and tearing down.

Both feed water pumps are equipped with a common suction line, the intake of each being blocked off with gate valves. In the event only one pump is in use, the suction of the idle pump can be closed off. The rubber suction hose leading to the water pit connects to the common suction manifold, center of photograph.

The discharge of the feed water pumps serves three purposes. Water is pumped up to boiler pressure before pushing the fluid through a feed water heater and into the boilers. Water is furnished to the derrick floor for cleaning purposes and for adding water to the mud, as well as other miscellaneous uses. Water is piped from the manifold to the blowout preventers to provide hydraulic power when it is necessary to open or close the preventers.

Flexibility of the foregoing operations is made possible by the feed water discharge manifold. The discharge of water can be directed through either of the two horizontal pipe members of the manifold by opening and closing the proper valves. The discharge from both pumps is such that one pump may be used to provide feed water to the boilers while the other pump furnishes water for the floor or for the blowout preventers. A unique feature of this combination is a provision for compounding both pumps in the event of high water pressures are required. The discharge of one pump is piped into the suction of the second stage pump to provide water at higher pressures.

HOW TO—Set Up Receiver for Shale Discarded by Shaker Screens



Shale, discarded by the shaker screens, can be piped conveniently away from the shaker assembly by mounting a receiver beneath the shaker apron. The receiver was made by using a convenient length of light-weight 20-inch pipe with each end closed with flat heads attached by welding. The joint of pipe was shaped by bending, to induce a slight sag midway between each end where a tangential nipple of ten-inch pipe was welded to attach the flume for disposing of the cuttings.

The shale receiver was attached, with bolted clips, to the fluid basin of the shaker assembly at a point where sufficient clearance could be obtained between the shaker apron and the receiver for the shale. After the receiver was shaped, a ten-inch section was removed from the top to allow the refuse from the screens to drop into the 20-inch pipe receiver. If heavy cuttings precipitate from the lighter particles in the receiver, or the disposal flume, water can be applied with a hose to agitate and wash the material away into the accumulation pit.

20,000 FT. WELLS?

LINK-BELT CHAINS ARE READY NOW!

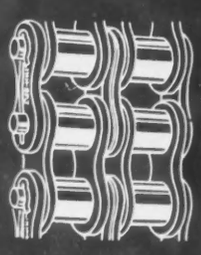
How long before 20,000 ft. wells will be as common as today's 15,000 ft. holes? Every year brings new depth records.

One thing you can be sure of . . . when the time does come to pierce the earth 4 miles in search of additional oil reserves. . . . Link-Belt Chain will be brawny enough, tough enough, efficient enough to do the job safely and economically.

Since chain was first used in the oil industry, Link-Belt engineers have never ceased matching chain design and construction to the ever changing needs and techniques of drilling. As your new drilling depths and problems arise, you will find that Link-Belt research has anticipated them.

LINK-BELT COMPANY 11,114

Indianapolis 6, Dallas 1, Houston 2, Los Angeles 33, Kansas City 6, Mo., New York 7, Toronto 8. Distributors in all fields.

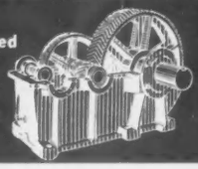


Silverlink Roller Chain

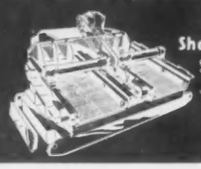
A.P.I. Chain

LINK-BELT

Serves the Oil Industry

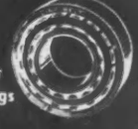


Enclosed Gear Drives



Shale Shakers

Silverstreak Silent Chain Drives



Roller Bearings

Ball Bearings

PENBERTHY
"Reflex"
WATER GAGE
SET

Reflex principle makes reading certain, instant and accurate. Water always shows black—steam always shows white. Water level is unmistakable. U-Bolt construction is strongest and simplest to service. Glass is replaced by removing nuts on front—unnecessary to work between gage and boiler. For oil field, locomotive type and marine boilers. Conforms to ASME, Federal and State requirements when used for pressures specified by their respective codes.

There is a Penberthy Gage for every liquid level gage requirement.

3277-E

PENBERTHY PRODUCTS

PENBERTHY INJECTOR CO.
Detroit 2, Mich.
Canadian Plant—Windsor, Ontario

HOW TO—Drive Pump with Army Tank Engine

Drilling contractors and oil companies alike have in many instances taken advantage of war surplus engines offered by the War Assets Administration. These engines have been used as prime movers for boats, pulling units, generators, and other applications requiring high-speed engines of medium power ratings. Such a gasoline engine, intended for Army tanks, has been adapted by a drilling contractor as the prime mover for the auxiliary pump on a 6000-foot rig.

The pump and engine have been mounted on the conventional skid-type frame made from I-beams and piping material. The engine has been aligned with the pump, and rests in a specially-designed mount encorporating two I-beams. Original brackets have been utilized, and the engine was mounted on rubber pads as originally intended. Scarcity of radiators brought about the installation of a second-hand tractor radiator which was bolted to the engine frame. The engine was boxed in with angle iron and covered on top and end with sheet steel. This framework provided support for ignition wiring, instruments, electrical parts and piping. A short handle hinged to the end member of the supporting frame served as the gear shift. The engine illustrated came equipped with hydromatic clutch which shifted automatically with load, thereby requiring no clutch lever.

The output shaft was terminated with two roller bearings, and the driving sprocket mounted between the bearings for a balanced load. Since the hydromatic clutch absorbed shock loads imposed by the pump, the contractor was able to equip the unit with chain drive instead of the accepted belt drive. The complete unit has served its purpose satisfactorily with very little attention.

HOW TO—Make Linkage for Shifting Gears

It is often the case with the small operator drilling his own wells that the difference between making a profit or taking a loss will depend upon how he minimizes his equipment investment. Small rigs have been assembled at a relatively small cost through the application of ingenuity and materials that happen to be on hand.

Illustrated is a "poor boy" rig containing none of the refinements common to modern power rigs. Unique in design is the method employed to shift gears of a heavy-duty truck transmission that has been adapted to a gasoline engine. Knuckle joints taken from the steering mechanism of wornout automobiles made the linkage from the driller's position to the truck transmission possible. Through this linkage, the driller can shift gears as easily as though he were driving a truck, and at the same time be in a position to observe and control other functions of the rig.

The gear-shifting linkage consists of a three-fourth-inch piece of pipe extending from the driller's position back to the engine. A right-angle handle at the driller's position makes it possible to pull, push and turn the pipe. Opposite end of the pipe is a short right-angle arm to the end of which is welded the ball of a knuckle joint. A cross rod pivoted at its center on a pedestal made from strap steel is fitted at each end with ball caps which make up the knuckle

Chapter Nine of The SCHLUMBERGER STORY

Secret Service!

Although your Schlumberger engineer is not a secret service agent, the confidential information he obtains is guarded by the integrity and reputation derived from years of confidential service over many hundreds of thousands of operations. Yes, Schlumberger service is secret service.

SCHLUMBERGER
WELL SURVEYING CORP.
HOUSTON, TEXAS

VISIBILITY
30 FEET

ACCURATE-STEADY
PRESSURE
MEASUREMENTS

On a drilling rig, where mud line pressures often become suddenly important, the across-the-floor readability of the large, bold, black figures against the contrasting yellow dial of the Mud Line Pressure Gauge offers a definite advantage.

Cameron Pressure Gauges are *accurate* because the unique design eliminates the conventional Bourdon tube and provides, instead, a spring loading design which is extremely accurate to line pressure changes. These Gauges give a *steady* reading because of a self-contained damping mechanism which is effective over the entire pressure range without adjustment.

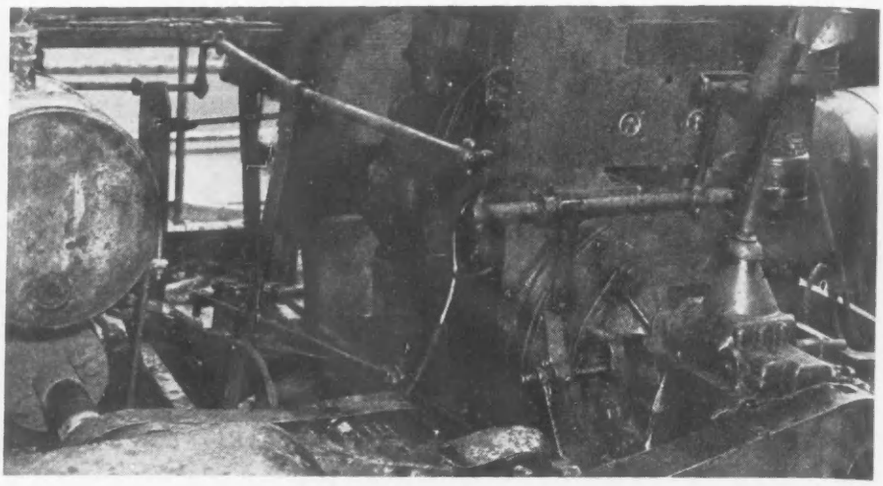
Sturdily constructed, and with the external parts working in oil, these fine Cameron Gauges are providing long trouble-free operation under the severe field conditions for which they were designed.

WRITE FOR FULLY DESCRIPTIVE LITERATURE

Cameron

IRON WORKS, INC.

P. O. BOX 1212 HOUSTON, TEXAS



joint. A similar short arm also equipped with a ball joint is welded to a horizontal rod held in position by two bearings. This rod is free to move longitudinally. At the far end of this rod is welded an upright which is fitted with a bracket joint. Hinged in this bracket is a short extension connected to the gear shift lever through another ball joint.

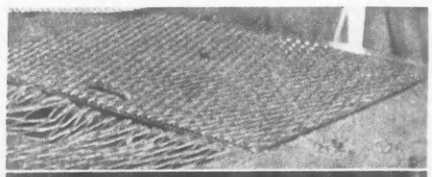
Through this linkage, movements of the drillers lever will be transmitted to the gear shift and the gears thus shifted.

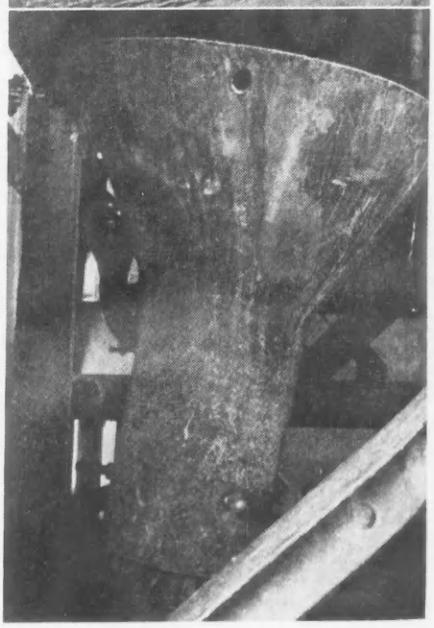
HOW TO—Make Under-Floor Rathole Device

The usual and conventional method of installing the casing for the kelly rathole is to leave the open end above the derrick floor. The end of the kelly can easily be steered into the casing, letting the kelly bushing rest upon the open end and support the weight in that manner. One company, after following this method for several years, found that sometimes the bushing might rest cornerwise for a moment, and after unlatching the hooks, a sudden jar would cause the bushing to fall slightly, thereby creating a drilling hazard which might be eliminated without much expense.

The rathole casing is fashioned in much the same manner as in the conventional method, but is set so the open end will be under the derrick floor. To further improve the kelly casing, this company supplies a funnel-shaped guide, shopmade of heavy steel, with the neck of the funnel large enough so it will slip snugly over the open end of the rathole casing.

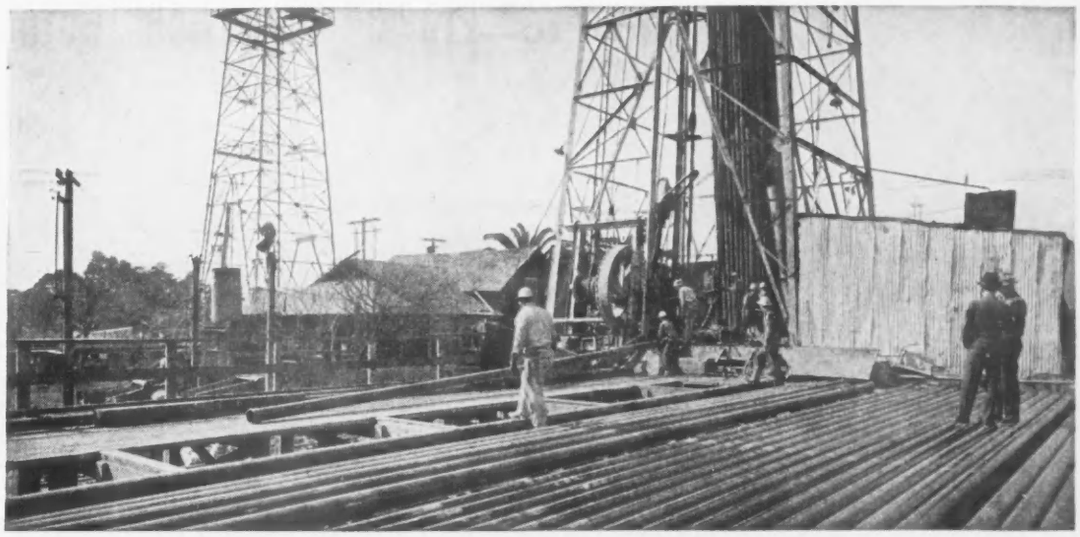
Set screws are placed on 90-degree centers to securely fasten the funnel-shaped guide to the end of the casing. When the kelly is lowered, the sloping sides guide the bushing to an accurate resting point eliminating subsequent movement after the hooks are unlatched. The portion of the derrick floor directly





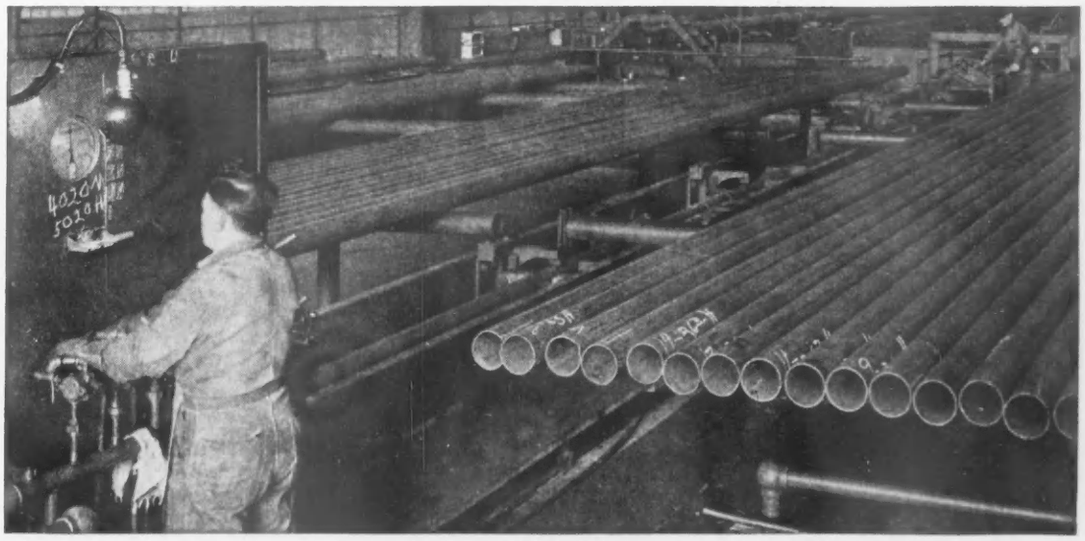
over the funnel-shaped end of the rathole casing is covered with a hinged door made of angle iron and heavy walk-way grating.

DEPENDABILITY



IN A CALIFORNIA FIELD: Running seven-inch S-80 SMITHway Casing.

THROUGH RESEARCH



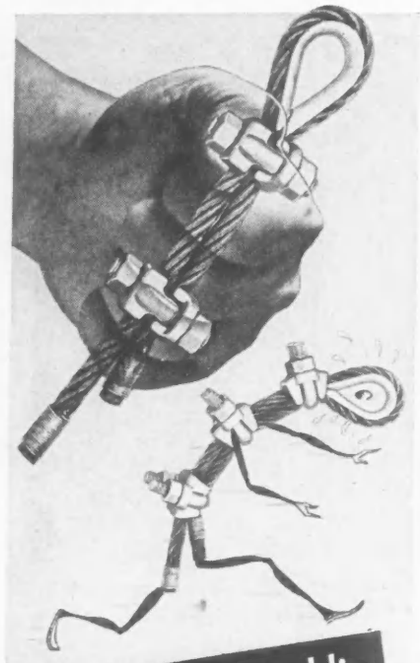
IN THE A. O. SMITH MILL: Hydrostatic-testing S-80 SMITHway Casing.

SMITH*way* CASING · LINE PIPE

A. O. SMITH CORPORATION

New York 17 • Pittsburgh 19 • Atlanta 3 • Chicago 4 • Tulsa 3 • Dallas 1
Houston 2 • Seattle 1 • Los Angeles 14 • International Division: Milwaukee 1

BANISH YOUR WIRE ROPE PROBLEMS



...With The Laughlin "FIST-GRIP" SAFETY CLIP

Won't Crimp or Crush... rope lasts longer.

Simple, easy to put on... saves time, manpower.

100% Foolproof... can't go on backwards.

Super Grip... two clips do the work of three U-Bolts.

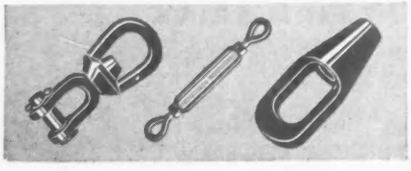
Extra Strength and Safety... clip and bolts drop-forged.

Distributed through mine, mill and oil supply houses. Write for Catalog 140 . . . up-to-the-minute data on industrial fittings.

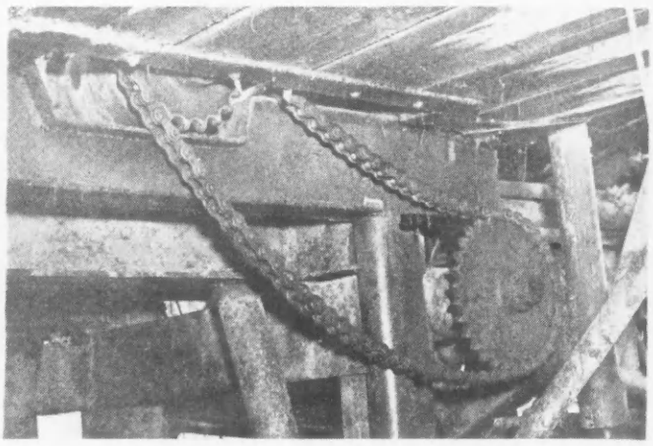
THE THOMAS LAUGHLIN COMPANY
Dept. 23, Portland 6, Maine

LAUGHLIN

THE MOST COMPLETE LINE OF DROP-FORGED WIRE ROPE AND CHAIN FITTINGS



HOW TO—Provide Underfloor Rotary Drive



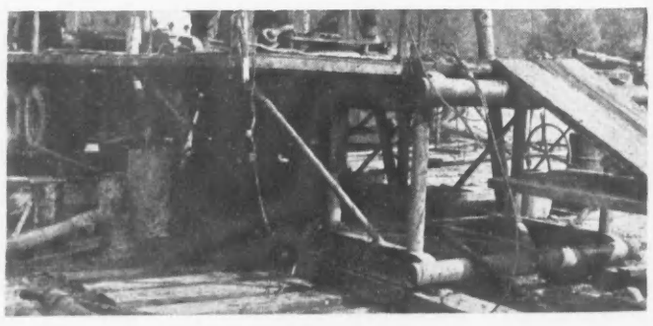
Limited floor space enclosed by the derrick of a 5000-foot portable drilling rig makes it necessary to keep as much of the equipment clear of the working area as possible in order that the crew can perform their jobs safely. By placing the rotary table drive below the derrick floor, considerable area was made available for better operating conditions.

The chain and sprocket arrangement illustrated eliminated the above-floor chain guards and resulted in the space saving. In order to accomplish this design, it was necessary to add the intermediate shaft shown driving the rotary. The shaft itself is permanently mounted on the derrick substructure which butts up to the heavy-duty truck carrying the drawworks and telescoping derrick. Large roller bearings bolted to the large end supporting legs of the substructure carry the intermediate shaft. During rig moves, this shaft remains in position, as does the rotary table which is mounted on the substructure, thereby expediting the setting up and tearing down of the rig.

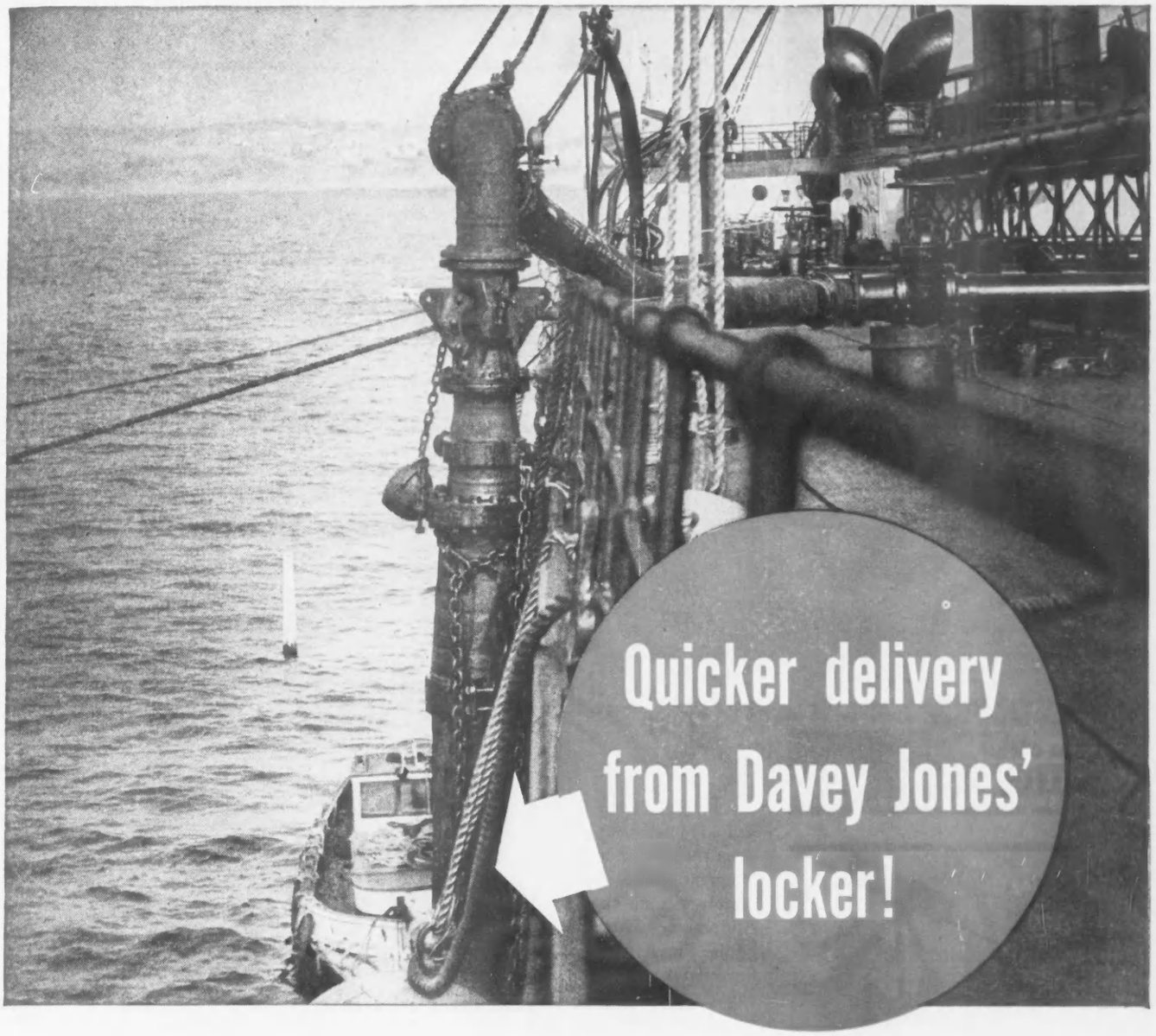
Between the two end bearings and near the opposite end of the intermediate shaft is located the sprocket which receives power directly from the drawworks. Sizes of both sprockets have been determined to give the desired rotary speeds. However, it was possible through the addition of the intermediate shaft to further increase the speed ratio of the rotary to jack shaft of the drawworks.

When dismantling the rig, the rotary drive is disconnected by simply breaking the chain connection between the drawworks and the intermediate shaft. In rigging up, the substructure is first levelled with the truck bed, and the driving chain from the drawworks is connected. The rotary table is bolted in recesses cut in the I-beams of the substructure so that the top surfaces of the rotary guard are nearly level with the derrick floor.

HOW TO—Make Skid-Substructure Combination



Moving heavy components of drilling rigs comprises much of the cost in drilling oil wells. Highway requirements in many oil-producing states impose added difficulties in any program to reduce moving costs. Because of weight restrictions and



Hewitt Sea Loading Hose gives you faster flow and longer service life

Here's how to move more petroleum faster . . . and reduce your costs at the same time.

Load and unload your tankers *off-shore* with Hewitt Sea Loading Hose! This time-proved hose, which is connected to your submerged pipe line, gives you a flexible, free-flowing passageway from ship to shore.

Its smooth bore internal tube permits up to 50% faster flow! This gives you from 70 to 90% the carrying capacity of a rough bore hose 2″ larger!

Furthermore, Hewitt Sea Loading Hose is extremely strong and tough. It's built to withstand terrific pressures, constant flexings, corrosive action and rough abrasive treatment. Special bead-wire reinforcement construction helps extend *service life* by millions of barrels!

For details phone the Hewitt distributor listed in the classified section of your phone directory. Or write to Hewitt Rubber Division, 240 Kensington Ave., Buffalo 5, N.Y.

HEWITT

Sea Loading Hose

HEWITT RUBBER DIVISION
INDUSTRIAL HOSE • BELTING • PACKING

HERE'S WHY YOU SHOULD BUY HEWITT SEA LOADING HOSE

1 50% Faster Flow! No exposed wire inside smooth bore! Nothing to impede free, self-cleaning flow. You can load up to 50% faster . . . save time loading and unloading.

2 No "Flagging." Multiple plies of specially woven high-tensile duck are completely protected from petroleum action. Special Hewitt Durabond process prevents leakage at nipples. Hewitt oil-resisting tube is securely bonded to carcass. Fabric cannot "flag" off and jam your pumps. Tube cannot "slip."

3 Greater Flexibility. Special Hewitt bead-wire construction eliminates permanent "set" . . . assures unusual flexibility . . . easy handling.

HEWITT-ROBINS HR **INCORPORATED**

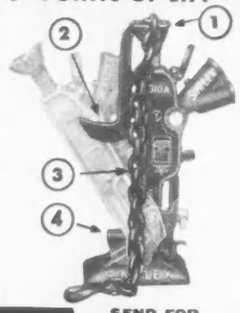
4-WAY LIFTING POWER with this SIMPLEX 310-A EMERGENCY JACK

Powerful 310-A Simplex EMERGENCY JACK is easy operating, will lift vertically or push or lift in any position.

"Get the Simplex" is the call on drilling jobs when men want quick, safe jack action. The double lever socket enables them to work in close quarters and at any angle.

This 15-ton Ratchet Lowering jack will lift or lower from four points—on the rotary cap, on the auxiliary cap shoe, on the serrated toe lift, or from any intermediate height by using the chain as a sling.

4 "POINTS OF LIFT"



Simplex LEVER · SCREW · HYDRAULIC Jacks

SEND FOR BULLETIN: Oil 48

TEMPLETON, KENLY & CO.
1032 S. Central Ave., Chicago 44, Ill.

DERRICK ESCAPE MECHANICISM

NET WEIGHT 15 LBS.

GLIDE TO SAFETY ON GERONIMO (Patent Applied For)

GERONIMO will stand hardest wear and give unfailing protection to refinery and derrick men whose lives are endangered by fire, escaping gases or other hazards.

EASILY ATTACHED OR REMOVED
EXTRA STURDY CONSTRUCTION
QUICKLY STRADDLED
POSITIVE, INSTANT BRAKE
BRONZE "No-Spark" SURFACES
RECOMMENDED FOR ½" WIRE LINE

• Write for Illustrated Folder •

SOLD THROUGH YOUR SUPPLY STORE
— MANUFACTURED BY —
CHARLIE'S MACHINE WORKS
PERRY, OKLAHOMA

limitations on size, many pieces of drilling equipment must be broken into several pieces in order to stay within the legal boundary. Illustrated is a unique skid-substructure combination which embodies a hinged flooring area for additional working space.

The substructure itself, which is within close limits of maximum highway width, is made of ten-inch I-beams and 4½-inch drill pipe. The I-beams form the lower and upper edges, and are bevelled at the ends where pipe cross runners are welded. Width of the substructure is the same width as that of the rear truck bed on which is mounted the drawworks and telescoping mast.

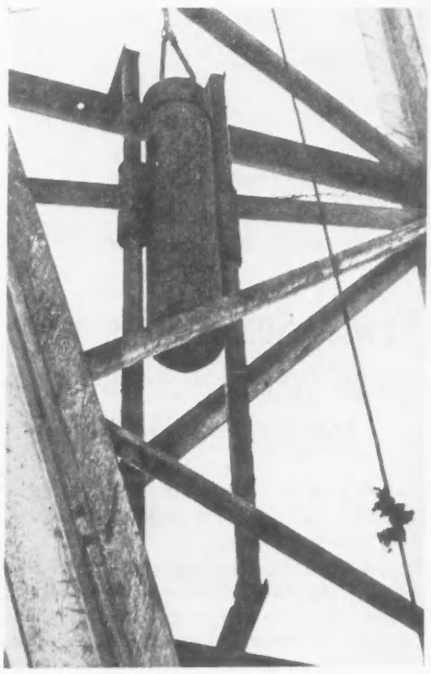
The entire structure is of sufficient length to provide ample supported space for all operations. Side boards hinged to the upper edges of the substructure are made of angle iron and filled in with heavy timber for flooring surfaces. These side boards are supported in a horizontal position by angle braces of 2½-inch pipe. Each brace is pounded flat at one end and drilled to fit in a bracket in the underside of the extension boards. The lower ends are welded to a short piece of angle iron which acts as a hand in holding the brace in position as shown. The complete unit is carried as one truck load and is placed in position by the truck's winch when unloaded. The side boards drop flat against the substructure while the braces extend inside. Two men can raise the side boards and place the braces in position.

HOW TO—Guide Tong Counterweights in Derrick

Cantilever-type drilling derricks have provided oil companies and drilling contractors with many time-saving features. Their adoption made it possible to completely rig up the drilling lines and all equipment associated with the derrick while the derrick was assembled in a horizontal position on the ground. Because of space limitations inside the relatively small structure, location and design of tong counterweights posed a problem. While not a difficult one, the design of these elements has brought about several different counterweight guides which serve a similar purpose.

Simple in construction and efficient in operation is the counterweight guide illustrated. Its primary purpose is to prevent the weight from swinging toward the center of the derrick and interferring with drilling operations. The counterweight body is a four or five-foot section of eight-inch casing, to the sides of which have been welded two short three-inch nipples. A salvaged casing collar was screwed into the top of the casing section and a sling added.

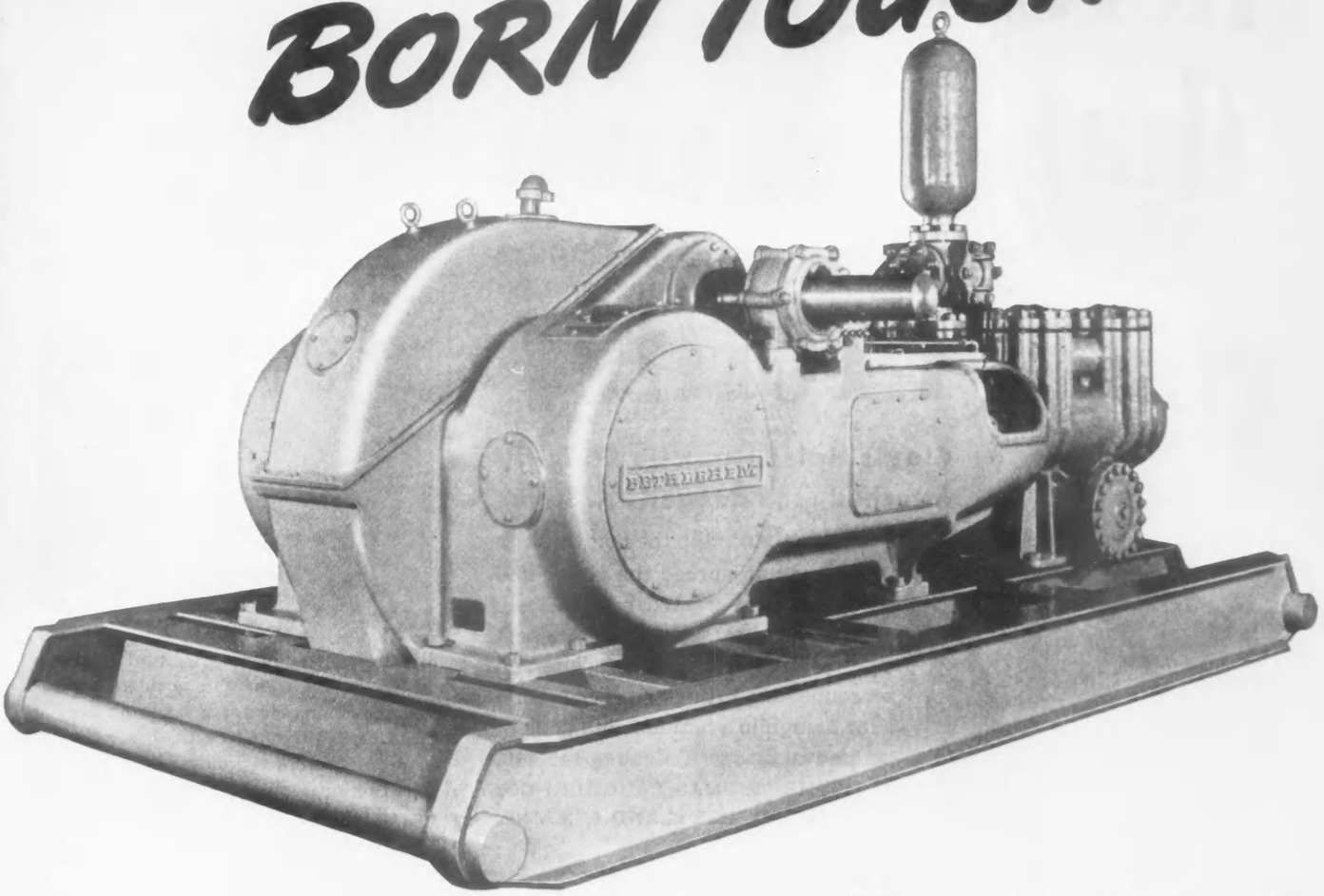
The short three-inch nipples slide up and down over two eight-foot pieces of two-inch pipe. The two-inch sections are held parallel by short pieces of angle iron which are welded to the cross braces of the derrick. Lubricated with heavy grease, the counterweight will easily slide up and down the guides to hold the pipe tongs in position. The



eight-foot travel of the counterweight provides an equal distance of travel of the tongs, being sufficient for any tonging operation on the floor.

During rig moves, the derrick is broken in sections, and it is not necessary to remove the counterweights or the guides from the structure. Thus, very little time is required to hook up the pipe tongs to the counterweights when rigging up.

BORN BIG... BORN TOUGH



Bethlehem's family of pumps has a husky new arrival.

It's the G-450, and it bears a strong resemblance to its powerful, time-tested older brother, the G-600. Not as large, of course, but its features are the same and it's a rough, tough slugger.

The 450 has the starch and stamina for deep-hole drilling. Simply hook it up, turn on the power, and whop!—it's in there punching for you!

8 reasons why the G-450 is a winner

Tri-phase lubrication
Overhanging crank construction
Steel fluid end
Heavy, rigid cast power frame
Flint-hard liners
100% roller-bearing construction
Removable crosshead slides and guides
Built-in tell-tale holes.

BETHLEHEM STEEL

BETHLEHEM SUPPLY COMPANY
General Offices: 21 E. Second Street, Tulsa, Okla.
Subsidiary of Bethlehem Steel Corporation

On the Pacific Coast Bethlehem Oil-Field Equipment is sold by Bethlehem Supply Company of California

Here are Hooks that hoist your Profits!

Clevis Hoist Hook Is Quickly Attached . . . Changed . . . Saves Time and Labor. Slip the bolt through the clevis, spin the nut, spread the cotter and this heat-treated hook's ready and safe for your toughest jobs. No welding, no spelter, no connecting fittings required. Send for Laughlin's famous data book of industrial fittings... Catalog No. 140.

THE THOMAS LAUGHLIN CO.,
DEPT. 23, PORTLAND 6, MAINE.

Laughlin Safety Hook . . . "The Latch Locks The Load" . . . adds a big safety factor to every lift. Sturdy latch, stainless steel spring. For every industrial application.

Laughlin Replacement Swivel Hook Assembly with Safety Latch. Bolts on and off . . . no machining . . . no threading. For hoists, cranes, lashing operations. One-ton and half-ton sizes.

LAUGHLIN

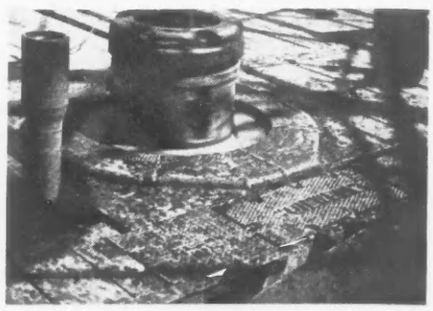
THE MOST COMPLETE LINE OF DROP-FORGED WIRE ROPE AND CHAIN FITTINGS

DRILLING HINTS

HOW TO—

Remove Obstruction On Derrick Floor

Safety measures have reached considerable importance in drilling operations. Every means possible is being taken to eliminate operating hazards which would endanger members of the crew or result



in damage to equipment. Stumbling hazards are high on the accident list as being responsible for a large number of injuries. In coping with the problem, many operators are eliminating as many obstructions on the derrick floor as possible.

Illustrated is one means which can be taken to prevent a stumbling hazard as well as to provide added convenience to the rotary helpers in making round trips. Many rotary tables are furnished with circular guard rings which project above the lower housing. Since this round guard ring makes it somewhat difficult at many locations to make a smooth joint between the rotary and the heavy timber flooring, one operator has squared off the upper surface of the table, thereby facilitating its installation in the floor and at the same time making an almost flat surface on which the crew may work.

The top footing surface of the guard ring has been extended by welding a steel plate around the rotary table as shown. A skirt of ¾ x 4-inch steel plate was welded to the outside edge of this plate to box in the rotary table. To further smooth out the working area, steel doors hinged to the timber flooring were added on each side of the rotary sprocket guard. These doors made it possible to reach the locking dogs from either side of the rotary table, while at the same time providing sturdy footing for the rotary helpers.

HENRY H. PARIS DISTRIBUTOR Inc.

Manufacturer's Agent - Oil Well and Refinery Supplies

P. O. BOX 932 — 1125 ROTHWELL ST.

HOUSTON, TEXAS

Harrisburg Forged Steel Flanges—Seamless Pipe Couplings

Harrisburg Drop-Forged Steel Pipe Flanges meet every test of strength and safety. Their unvarying uniformity merits your consideration wherever quality is essential. Made to ASA standards.

Harrisburg Forged Seamless Steel Pipe Couplings are uniform in strength and quality. Threads will not strip under most severe strain. Manufactured to API specifications.

Agent and Distributor for the following Nationally known Manufacturers

W. C. NORRIS MANUFACTURER, INC.
Tulsa, Oklahoma
Quality Pumping Equipment, Swage Nipples, Bull Plugs, Welding Fittings, etc.

WHEELING MACHINE PRODUCTS CO.
Wheeling, West Virginia
XL Steel Pipe Couplings for OIL COUNTRY TUBULAR PRODUCTS. Gas-Water-Steam.

THE OHIO INJECTOR COMPANY
Wadsworth, Ohio
OIC VALVES, Bronze, Iron and Steel, for all purposes. "Oh! I See Lower Costs with OIC."

HARRISBURG STEEL CORPORATION
Harrisburg, Pennsylvania
Forged Steel Flanges and Seamless Casing Couplings.

VOLCANO BURNER COMPANY
Houston, Texas
Volcano Superior and Gulf States All Steel Gas Burners for OIL COUNTRY BOILERS

OIL STATES EQUIPMENT COMPANY
Houston, Texas
OSECO Silvertop Fusible Plugs with renewable inserts for all types OIL COUNTRY BOILERS.

DRESSER MANUFACTURING DIV.
Bradford, Pa.
Seamless Welding Fittings

90 Deg. DRESSER ELLS

Made by an exclusive process from seamless steel pressure tubing, meeting ASTM A-234 standards, Dresser Ells are cold formed to assure optimum physical properties of the metal. Center-to-face dimensions held to one and one-half times the nominal size. Minimum wall not less than thickness of specified pipe. Straight tangent on both ends means, 1) Weld removed from plane of greatest stress, 2) Straight bead welding permitted, 3) Pipe alignment simplified.

The **Igloo WATER COOLER**

"the truly Convertible Cooler"

This cooler is corrugated for greater strength and durability being of all welded construction. It is fully insulated with granulated cork to keep water colder longer. Added features include, conversion from spigot to non-spigot type, no solder joints to break out and a reinforced innerbottom.

Igloo Water Coolers and Spigots Are Available at All Supply Stores

The IGLOO MANUFACTURING CO.

3809 McKinney Avenue — Houston 3, Texas

LOG WHILE YOU DRILL...

Geograph logs foot by foot . . . 24-hours a day . . . shows formation changes, drilling depth and down time - - at all times!

Geograph saves in many ways for both large and small operators! Write for details now!

"TIME WILL TELL"

THE GEOLOGRAPH CO. INC.

P. O. Box 1291 — Oklahoma City 1, Okla.

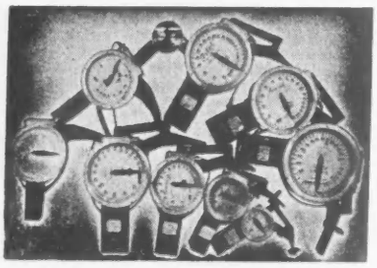
Sterling
PUMPS • HOISTS • LIGHT PLANTS

DEPENDABLE
RUGGED
SIMPLE
•
SAVE
MONEY
SAVE
TIME

STERLING QUALITY

See pages 3984 and 3985, Composite Catalog, and page 761, Refinery Catalog.

STERLING
MACHINERY CORPORATION
405-13 SOUTHWEST BLVD. KANSAS CITY 10, MO.

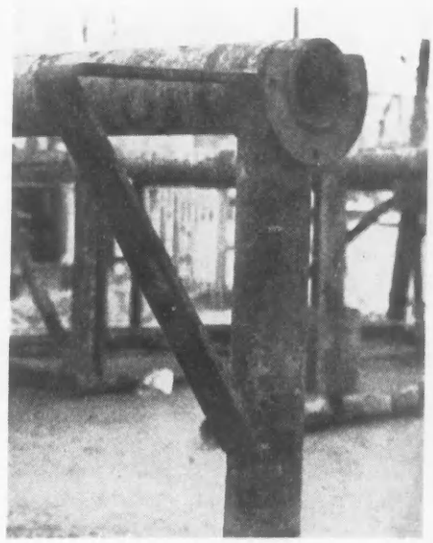


20 MODELS
LINE SCALES
40,000 to 500,000 Lbs. Capacity!
Widely used because they are always accurate, sensitive, rugged — and economical. With a Line Scale you KNOW the pull on the line, and the weight on the bit, in pounds! See your local supply man for details.
LINE SCALE CO., Inc.
907-11 SE 29th, Box 4245, Phone 6-1765
Oklahoma City, Oklahoma

MASS PRODUCTION?
NO!
NOT IN OIL EXPLORATION!
CAREFULLY INDIVIDUALIZED
GEOPHYSICAL WORK
ADAPTED TO THE
FACTS IN EACH PARTICULAR
CASE, BOTH IN THE FIELD
AND IN THE OFFICE.
KLAUS
EXPLORATION CO.
LUBBOCK, TEXAS

HOW TO—Attach More Sections to Pipe Rack

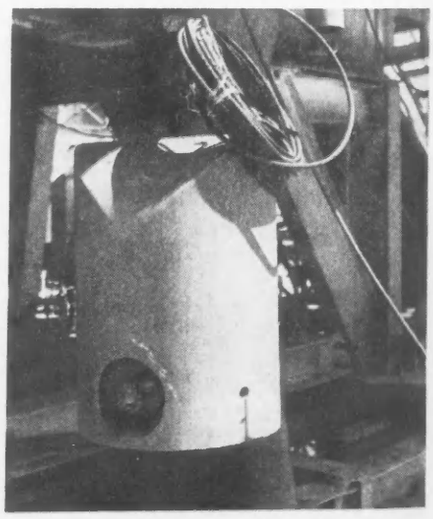
Any additional number of sections can be attached to a pipe rack to afford extra storage space for drill pipe and casing by placing fittings on the ends of all sills. A pipe rack may be made from joints of salvaged pipe. The horizontal sills are threaded at the end to accommodate screwed fittings. Companion flanges are attached to the sills and screwed up with tongs until the pipe ends are flush with the gasket side of the flanges. The flanges are then spot-welded to anchor them permanently in the desired position, after which the top section of each flange is cut away along a line slightly below the top surface of the sill. In this manner pipe will roll freely onto the rack when it is assembled without striking a projection, such as would be present if the top of the flanges were left intact.



Four bolt flanges are adequate to sustain the load of connecting the rack sections, consequently each flange is attached in exactly the same relative position as the others. This is done so that the three remaining holes match a similar companion flange for inserting bolts when one section is placed beside another to make the entire rack wide enough to hold the desired amount of drill pipe, casing or tubing.

HOW TO—Avoid Damage to Regulating Valve

It has become common practice to utilize as a tong counterweight a water-filled container which is suspended beneath the rig floor. Such a container usually consists of a large diameter bucket or length of pipe which is equipped with a small valve on the bottom for easy draining or close regulating of the weight desired. One company has improved the design of such a counterweight by providing a means of protecting the regulating valve from breakage or injury.



A round hole was cut out of the side of the container near the bottom and a short length of eight-inch pipe welded in, forming a recessed area in which the regulating valve could be mounted. A horizontal length of one-inch pipe was run through this opening, the pipe being open to the interior of the chamber at one end and emptying to the outside at the other end. The pipe was welded in at the three points where it passed from one chamber to another. Mounted in this position, the valve is protected from breakage during the rough handling sustained in moving and rigging up, yet it is readily accessible when the container is drained or weight adjustments are made.

Here is—

STRAIGHT HOLE DRILLING *Insurance!*

Your well surveying worries are over when you put a Sperry-Sun E-C Inclinometer on the job. Here, in one simple, convenient package is everything necessary to insure quick, positive, accurate, easily read and permanent records at any depth. For instance:

E-C provides multiple records in a single round trip...
E-C double checks each record for positive, dependable information . . .
E-C requires no complicated developing—records are immediately available on the job . . .
E-C can be run by crew members on wire line, core barrel overshot, go-deviled, or inside bailer.

Furthermore, you have no bothersome delays waiting for instruments to be repaired or serviced. E-C Inclinometers are not sold. They are furnished on a low-cost, lease-rental basis, which permits immediate replacement and factory maintenance to assure perfect operating condition at all times.

Our nearest service engineer will gladly furnish full details how you, too, can profit from E-C "Straight Drilling Insurance."

★SURWEL SERVICE ★SYFO CLINOGRAPH ★E-C INCLINOMETER ★NON-MAGNETIC DRILL COLLAR

SPERRY-SUN

SPERRY-SUN WELL SURVEYING COMPANY

3118 BLODGETT AVENUE HOUSTON, TEXAS

SYMBOL OF PROGRESSIVE LEADERSHIP IN THE SCIENCE OF WELL SURVEYING

Philadelphia, Pa. Fullerton, Texas Odessa, Texas Marshall, Texas Long Beach, Calif. Oklahoma City, Okla. Lafayette, La. Bakersfield, Calif. Maudem Oil Field Services, Casper, Wyo.

Deep Oil In Illinois

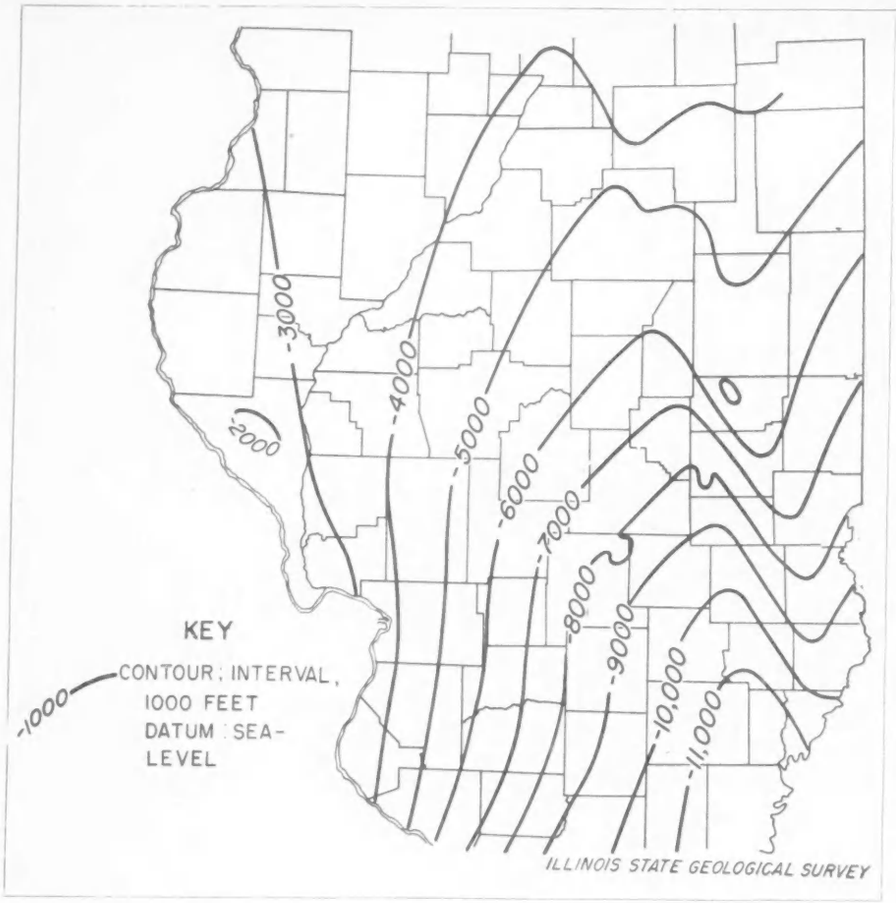


FIGURE 1. Structure of surface of basement complex.

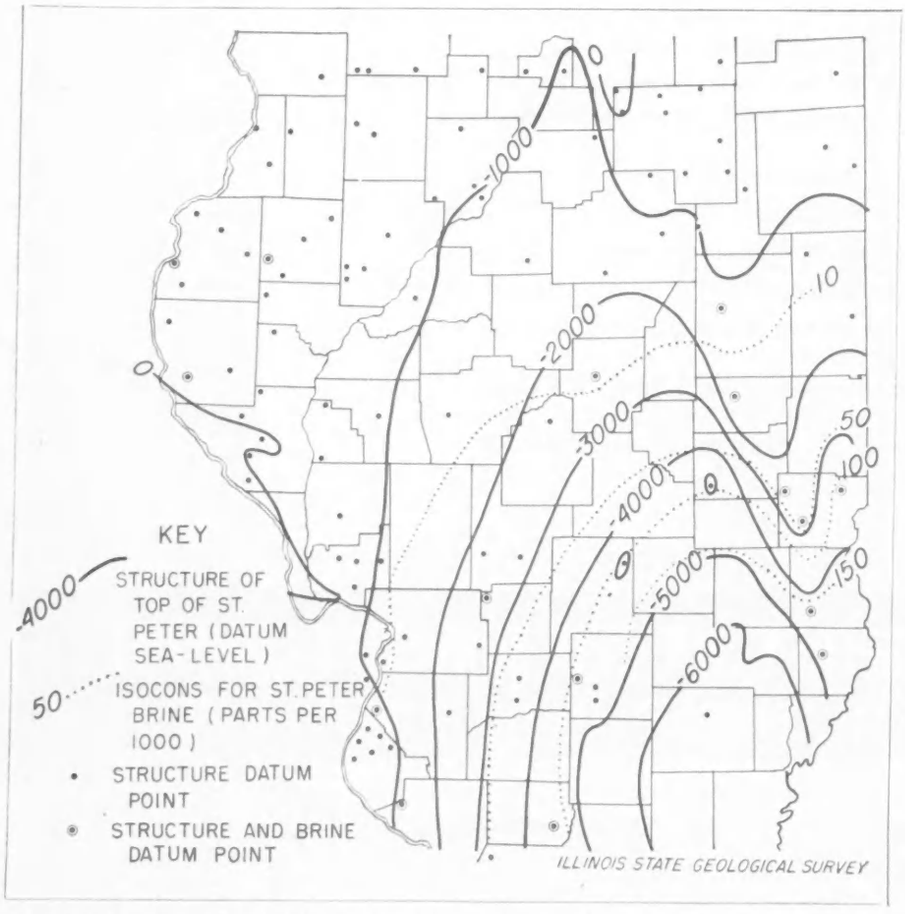


FIGURE 2. Structure of top of St. Peter formation and isocons of dissolved minerals in water from the St. Peter.

DURING the past four years, 16 wells have been drilled in Illinois to test for oil in the St. Peter or deeper formations. Thirteen of them were drilled below the St. Peter and two reached the basement rocks. These tests were along the west side of Illinois from Madison to Hancock counties and in central to northern Illinois from Douglas to Lee counties. No oil was obtained, but the geologic data revealed by these wells should be reviewed in conection with any plans for further prospecting for oil in the deeper sedimentary rocks of Illinois.

The lower limit for possible oil production is considered to be the top of the pre-Cambrian or "basement" crystalline rocks. A contour map of the surface of the basement rocks is shown in Figure 1. This surface has actually been reached in only six wells located near the periphery of the basin, but enough deep wells have been drilled in the marginal areas to reveal the trend of thickening of formations so as to allow estimates to be made of the depth to the basement surface in the basin.

Elevation of the top of the St. Peter sandstone and the concentration of dissolved mineral matter in water from the St. Peter sandstone are shown in Fig. 2.

A comparison of Figures 1 and 2 indicates that the estimated thickness of Paleozoic sediments below the top of the St. Peter in Illinois varies from about 2000 feet to more than 4000 feet.

The locations of two cross-sections are shown in Figure 3 and the cross-sections in Figures 4 and 5. Many of the wells used in the cross-sections were drilled in the past four years. Indicated are the general lithologic characters of the formations, lateral variations in thickness and lithologic characters, and correlations between the geologic column of the Wisconsin area and that of the Ozark region in Missouri.

Drilling to date has not indicated favorable prospects for oil in the St. Peter and lower formations in about the northern one-third of Illinois. The The remaining two-thirds of the state are largely untested below the St. Peter and therefore are regarded as having oil

Possibilities

By L. E. WORKMAN and ALFRED H. BELL
Illinois State Geological Survey

possibilities in porous zones in the St. Peter and lower strata.

The St. Peter sandstone itself has been tested and found dry on a number of prominent structures in the basin area, including Louden, Salem, Mattoon, the La Salle anticlinal belt in Douglas, Clark, Crawford, and Lawrence counties, the Noble[1] Anticline, and the Du-Quoin Anticline. On the Mattoon Anticline oil stains were found in a few feet of the Glenwood sandstone immediately above the St. Peter sandstone, but no oil shows were found in the St. Peter or Glenwood in the test wells on the other structures mentioned. In the Pure-Billington deep test in the Cisne pool on the Noble Anticline, the St. Peter was found to be tight and quartzitic.

Zones deeper than the Gleenwood-St. Peter sandstones that are especially porous are the crevices and cavities in the Shakopee dolomite, the porous New Richmond sandstone in its area of considerable thickness in central Illinois, the crevices and cavities in the Trempealeau dolomite, the Galesville sandstone north of its wedge edge, irregular portions of the Eau Claire, and the Mt. Simon-Fond du Lac sandstone. These strata have been tested in only a few spots and no authenticated shows of oil have been reported in them.

Nearly all of the oil fields of Illinois are included within an area of about 12,000 square miles in the southern half of the state. About 75 percent of the total oil has come from the Mississippian strata, about 20 percent from Pennsylvanian strata, about 4 percent from Devonian, and only about 1 percent from the Silurian and Ordovician together. All of the Ordovician oil is from the "Trenton" in the upper part of the system. Thus, there is a general decrease in oil productivity by systems down from the Mississippian.

This may appear to be due to the fact that the amount of drilling becomes less with increased depth, but actually there may be less oil in the deeper formations. In oil fields with production from several zones widely separated in depth; for instance, Westfield, Salem, and Louden, production areas are notably smaller for the deeper zones. If this trend toward smaller productive areas continues downward, such oil accumulations as may exist in the pre-St. Peter Ordovician and in the Cambrian formations on known structures are likely to be small in extent.

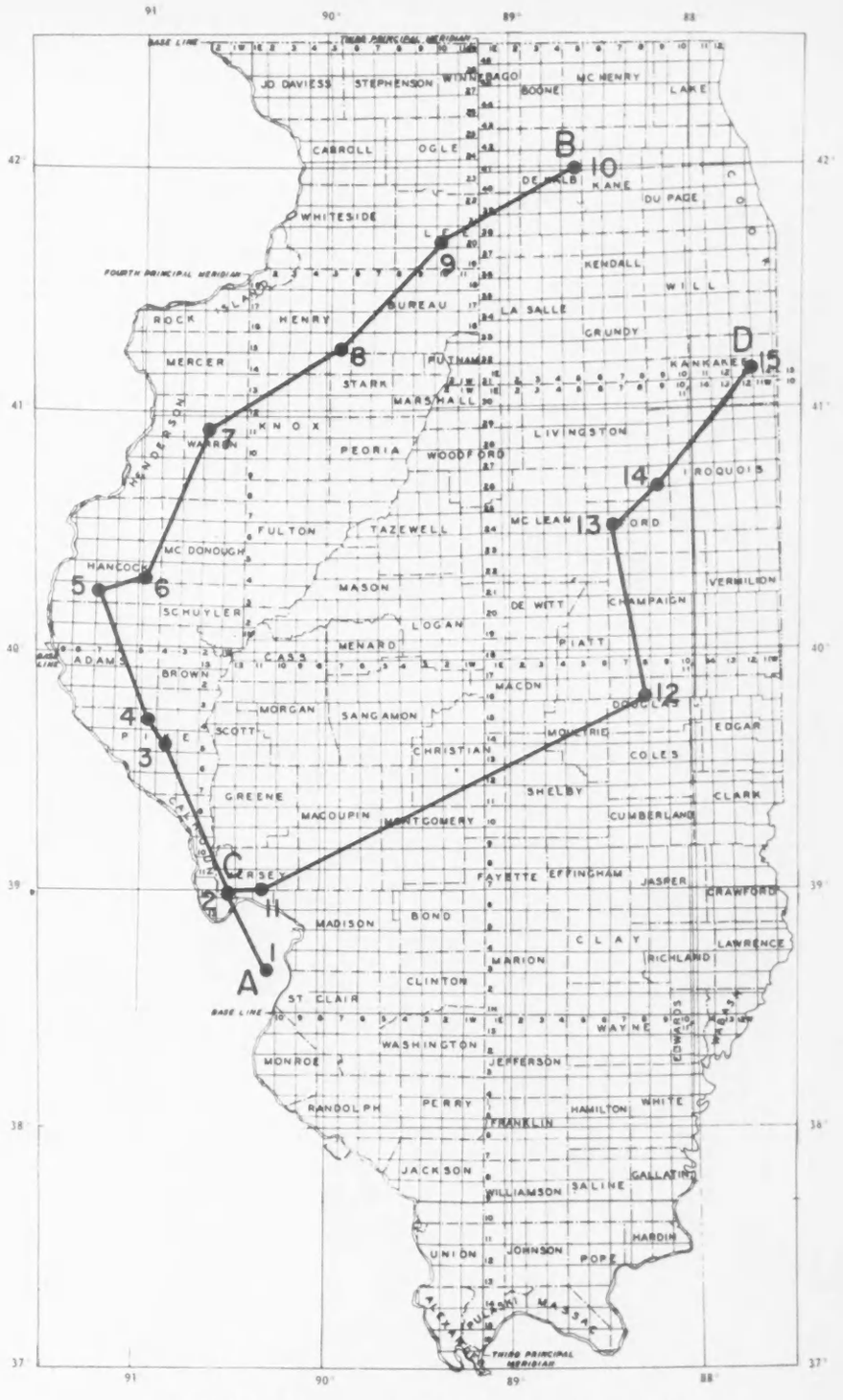


FIGURE 3. Locations of geologic cross-sections AB and CD.

the deeper zones. If this trend toward smaller productive areas continues downward, such oil accumulations as may exist in the pre-St. Peter Ordovician and in the Cambrian formations on known structures are likely to be small in extent.

It must be recognized that there are possibilities of the existence below old unconformities of structures that are not reflected in known key horizons. It appears that the only chance of finding such structures in advance of drilling would be by geophysical methods. Also stratigraphic traps may exist in Ordovician and Cambrian rocks as well as in younger systems.

REFERENCE

[1]Name proposed by Darsie A. Green in paper presented at the AAPG Mid-Continent regional meeting in St. Louis, January 14-15, 1948, for the Clay City anticlinal belt.

ACKNOWLEDGMENT

This article is a summary of a paper read at the Eastern Interior Regional meeting of the American Association of Petroleum Geologists in St. Louis, Missouri, January 15, 1948, a manuscript for which has been submitted to the Association.

Published by permission of the Chief, Illinois State Geological Survey, Urbana, Illinois.

(See Figures 4 and 5, pages 132 and 134)

TOP: Huge drop hammer anvil is lowered into new 6′ foundation pit — relocated in less than two hours! LEFT: Jacks, skids, and back-breaking labor eliminated here by TOURNAHAULER'S self-loading traveling hoist. ABOVE: Big rubber tires cushion load from road shocks, permit on or off road travel. BELOW: Here, powerful TOURNAHAULER speeds up 10 to 15% grade despite emergency overload.

TOURNAHAULER SPEEDS TOOL WORKS RE-LOCATION

SELF-LOADING RIG MOVES LEBUS ROTARY TOOL WORKS THREE MILES TO NEW PLANT IN ONE-THIRD OF EXPECTED TIME . . !

Lebus Rotary Tool Works, Greggton, Texas, had some tough moving problems when they recently built a new plant three miles away. All types of heavy precision machine tools had to be carefully lifted, safely loaded, transported and unloaded, and then accurately reset. Lost time meant lost production—and *LOST PROFITS!*

● ELIMINATES SKIDS, JACKS, HEAVY LABOR

Assigned to lick the job was a big self-loading TOURNAHAULER*, job-rated at 30 tons. It moved into die and production shops, loading lathes, shapers and shears . . . into the hammer shop for furnaces, boilers, forging presses and huge drop hammers . . . rig's overhead traveling hoist eliminated skids, jacks, heavy labor and allowed each unit to be quickly and easily loaded, secured and carried away for immediate re-setting. As part of the job, 800 tons of steel was transferred in just four days!

● 50% LESS EQUIPMENT REQUIRED

Owner Frank Lebus reported relocation completed in less than one-third the time and with 50% less equipment than would have been required by conventional methods. He emphasized, "For efficiency, economy and speed there's nothing like a TOURNAHAULER — you can dismantle a plant and set it up again in no time!"

● THERE'S A TOURNAHAULER FOR YOUR JOB

This job is typical of TOURNAHAULER versatility, in plant or out in oil field mud and sand. So, when you have troublesome heavyweights to move, slush pumps, draw works, transmissions, engines, or when relocating a refinery or similar installation, remember TOURNAHAULERS are designed and engineered for the toughest off-road hauling . . . and there's one for every type of job — *YOUR JOB!* Write today for LeTourneau engineers' solution to your specific hauling problem . . . no obligation, of course.

*TOURNAHAULER — T. M. Reg. U. S. Pat. Off.

LETOURNEAU LET EQUIPMENT

R. G. LETOURNEAU INC

TOURNALAYER DIVISION Longview, Texas

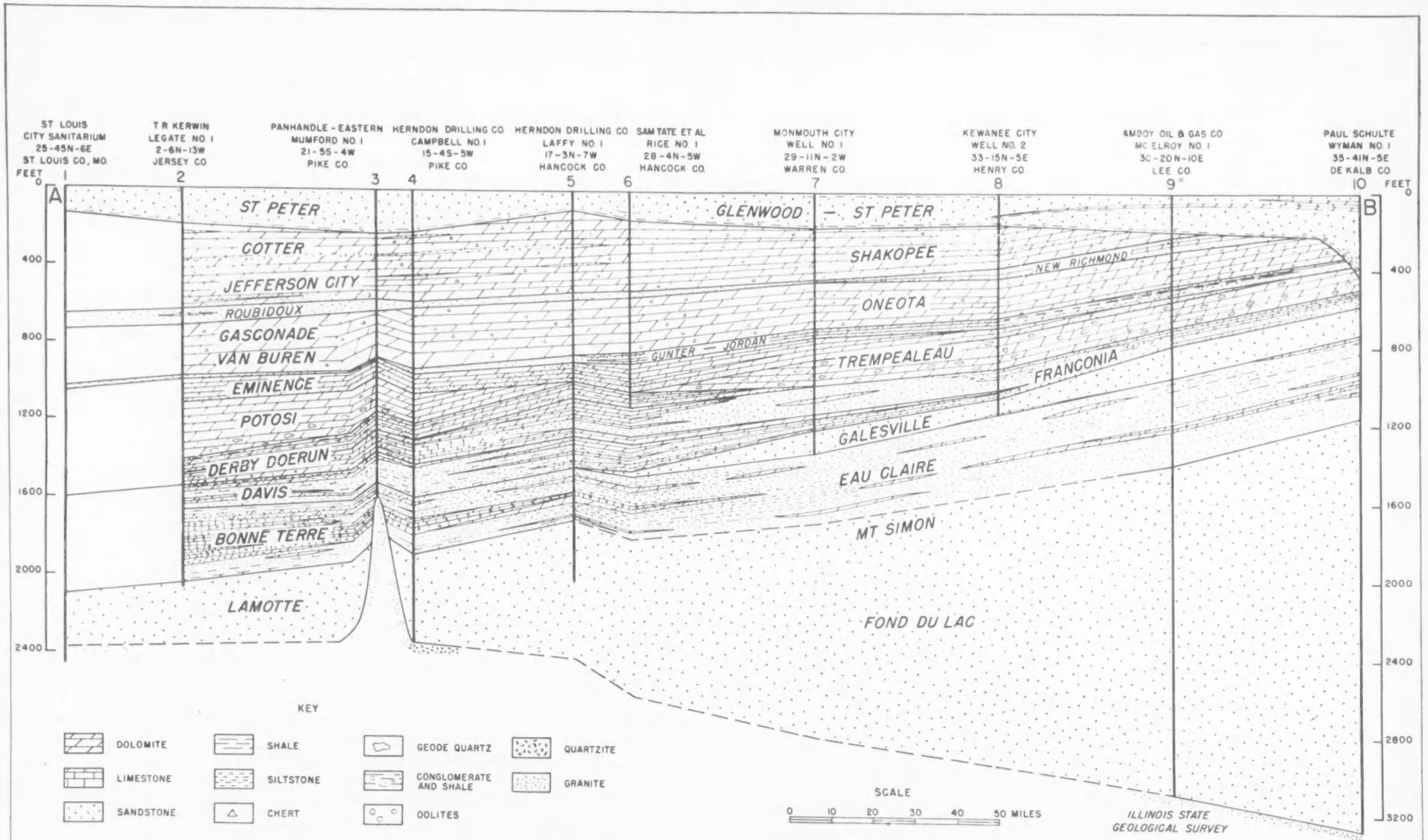


FIGURE 4. Geologic cross-section AB.

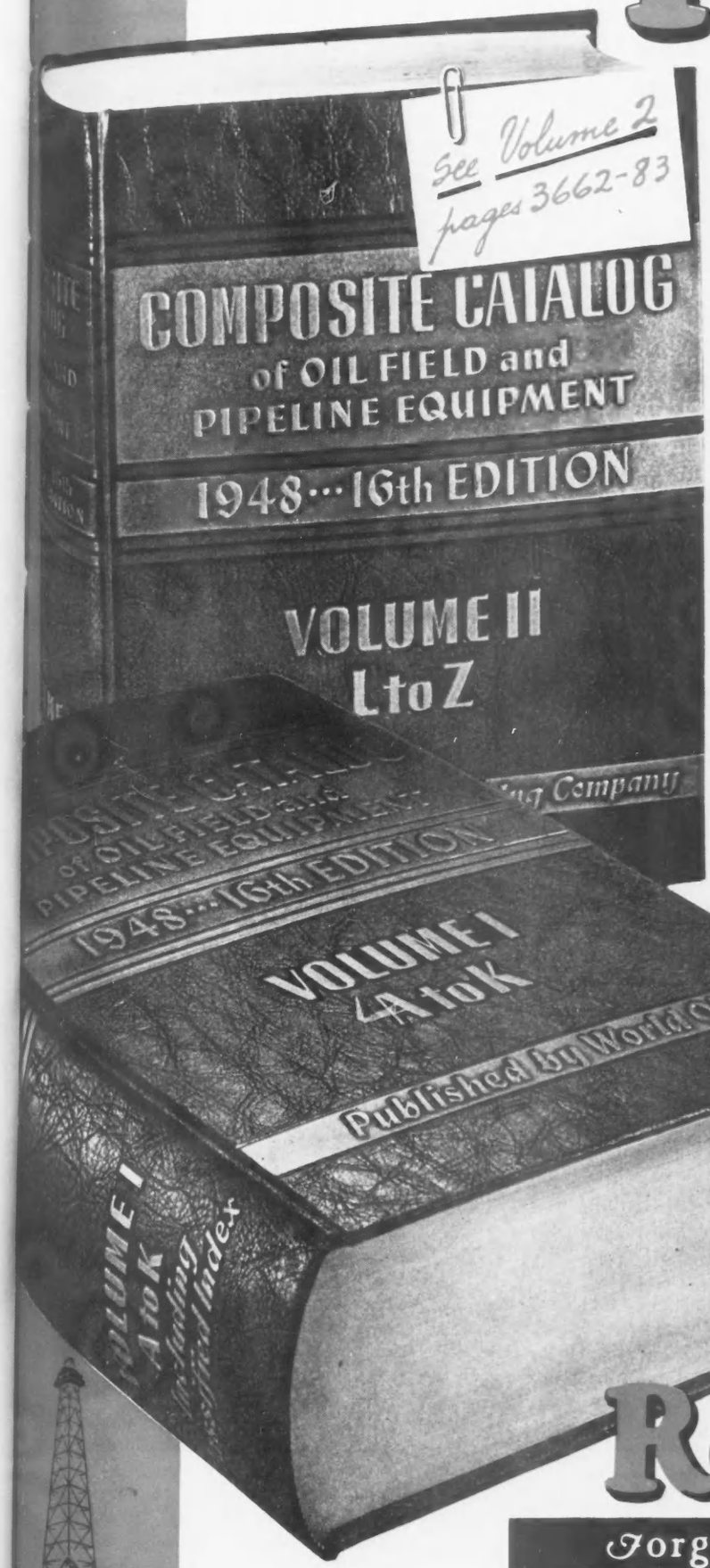
...it's **Regan**

for **OIL FIELD EQUIPMENT**

IN THE 1948 EDITION OF THE

COMPOSITE CATALOG

of OIL FIELD and PIPE LINE EQUIPMENT



√YOUR READY REFERENCE FOR

CROWN AND TRAVELING BLOCKS FOR PORTABLE AND PERMANENT RIGS
TONG BLOCKS • TUBING BLOCKS
SWABBING BLOCKS
GINPOLE BLOCKS
COMBINATION HOOKS
ELEVATORS
BLOWOUT PREVENTER
WIRE LINE STRIPPERS
ROD WIPERS
CASING AND TUBING HEADS

Regan Built for Longer Life!

Regan

Quality – Wrought on the Forge of Experience

2-C

Forge & Engineering Co.

SAN PEDRO, CALIF.

Exclusive Mid-Continent Representatives:
Hunt Tool Co.,
P.O. Box 1436, Houston, Texas

HOUSTON, TEXAS

Exclusive Export Representatives:
Hunt Export Co., 19 Rector St., New York, N. Y.
Avda Pte., R. Saenz, Pena 832, Buenos Aires, Argentina

Send for Special Bulletins

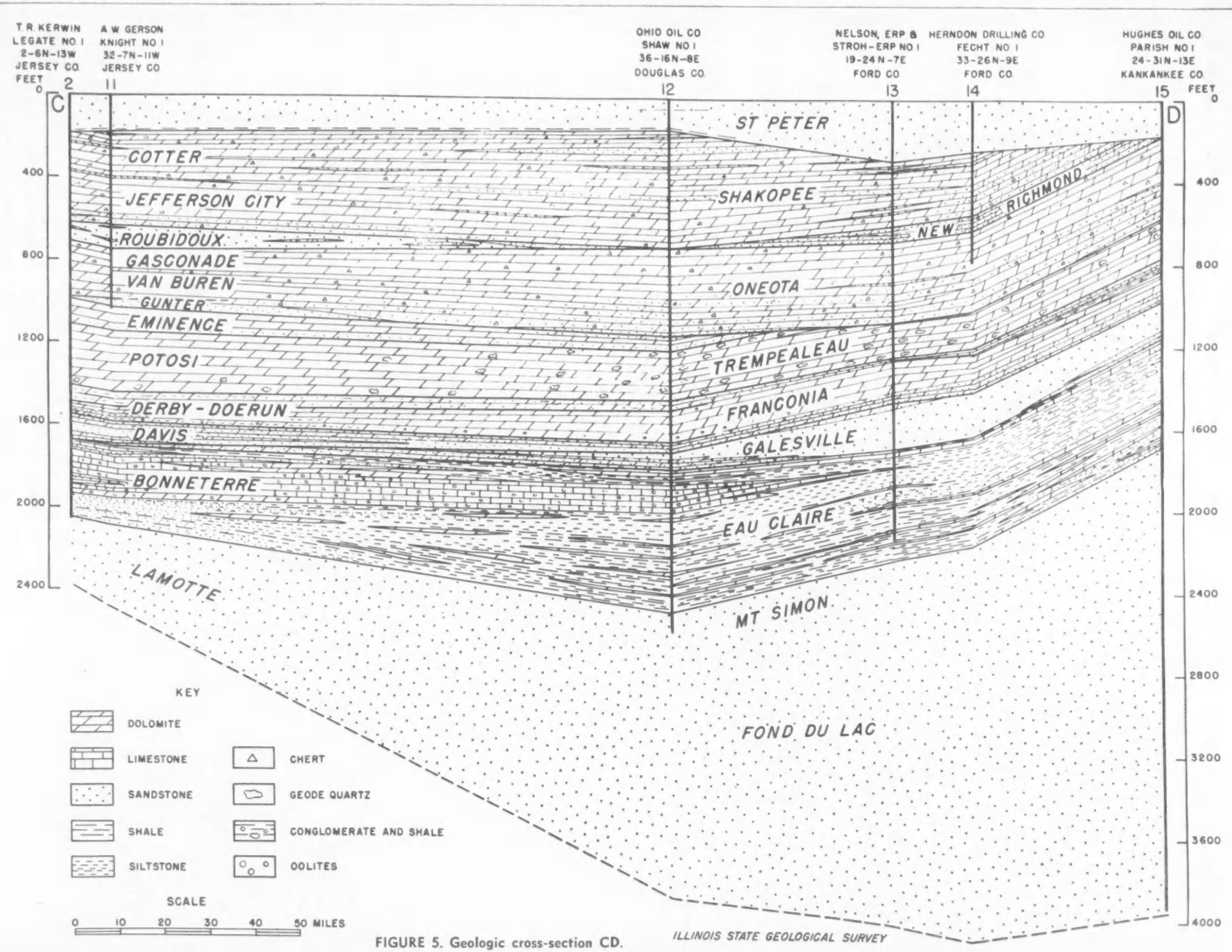


FIGURE 5. Geologic cross-section CD.

FACTORS WHICH enter into rod service are examined, and each is evaluated as to the manner in which it may be revised to allow for deeper pumping in step with the trend toward deeper horizons and lowered fluid levels in existing producers. Limiting depths and maximum stresses are plotted to determine safe working limits under various combinations of equipment.

DEEP Oil Well Pumping

By KENNETH N. MILLS
Assistant Chief Mechanical Engineer
Emsco Derrick & Equipment Company

As THE maximum depth of producing formations and the age of the older deep producing formations increase, the maximum depth of wells requiring artificial lift increases. Within certain limits, depth is no particular problem in producing a well with sucker rods, but as the total well load approaches the maximum working load of the sucker rods, a temporary maximum depth is established. Technological developments in material, equipment and production practices have kept pace with this problem and as the demand arises will further increase the maximum sucker rod pumping depth. If the endurance limit of the sucker rod material is increased 20 percent by improved material or heat treatment, the maximum pumping depth for a given set of pumping conditions is increased by approximately 20 percent. If the dynamic well load can be decreased by either advanced surface equipment or improved production practices, the maximum pumping depth can be increased in proportion to the load reduction. Further increases in the maximum practical pumping depth can be achieved by overstressing the sucker rods and using a pumping cycle which will obtain a satisfactory balance between rod cost and production.

Load Factors

To determine the limitations on sucker rod pumping and evaluate the various possibilities of extending the range of usefulness of this pumping method, it is necessary to understand the contribution of the various factors influencing the peak well load to this load. Basically, the sucker rod load consists of the weight of the fluid column on the plunger, plus the weight of the rods, plus the force required to place the rod in motion. If the entire mass of the static well load were concentrated at the polished rod, the problem would be very simple, because the entire mass would be accelerated at the rate imparted to it by the surface machinery, and the problem of longitudinal vibration would not exist. As the weight of the rods is distributed over several thousand feet, time is required for a force applied at the surface to reach the traveling valve, and the entire mass of the rod string is not accelerated at a constant rate. To add to the complexity of the problem, the sucker rod string vibrates longitudinally, and the stresses induced by these vibrations add to the dynamic and static rod stresses.

After a thorough investigation[1] of the motion imparted to the rod string by conventional pumping units, the writer suggested a well load formula[2] which recognized some of these problems. This formula was based on the assumption that the peak rate of acceleration imparted to the polished rod corresponded to the maximum attained in simple harmonic motion, and that only the weight of the rods was accelerated. The assumption that the fluid mass is not accelerated is based on the facts that motion is not imparted to the fluid column until after the rods have passed through the period of peak acceleration and the acceleration force imparted to the fluid is dissipated in fluid compression. When it is realized that the rate of stress transmission in steel is about four times the rate of stress transmission in well fluid, it is obvious that the same acceleration factors cannot be applied to each of these loads. As oil well fluids all contain gas they are compressible and momentary accelerations of the plunger will be dissipated in fluid compression and friction, and therefore, the fluid acceleration factor is unity. The accuracy of the well load formula has been compared with that of several well load formulas, and in the majority of the cases investigated, it was found to be more accurate.[3] The formula suggested is given below and was used in this investigation:

$$PL = W_O + W_R\left(1 + \frac{LN^2}{70{,}500}\right)$$

Where:

PL = Polished rod loads, lbs.
W_O = Weight of fluid on net plunger area, lbs.
W_R = Weight of rods in air, lbs.
L = Length of surface stroke, inches.
N = Number of strokes per minute.

From this formula, it is apparent that the peak well load varies with the square of the pumping speed and as a linear function of the length of stroke. This would indicate that a relatively slow rate of pumping speed is desirable, if minimum sucker rod loads are to be attained. Also, it indicates that the increase in productive capacity gained by increasing rod stress is greater than the ratio of the rod stresses, because only the weight of the rods is accelerated, and the added stress is used to lift oil which is not accelerated.

As the pumping motion on an oil well is reversing and the sucker rods are accelerated and decelerated, there is a

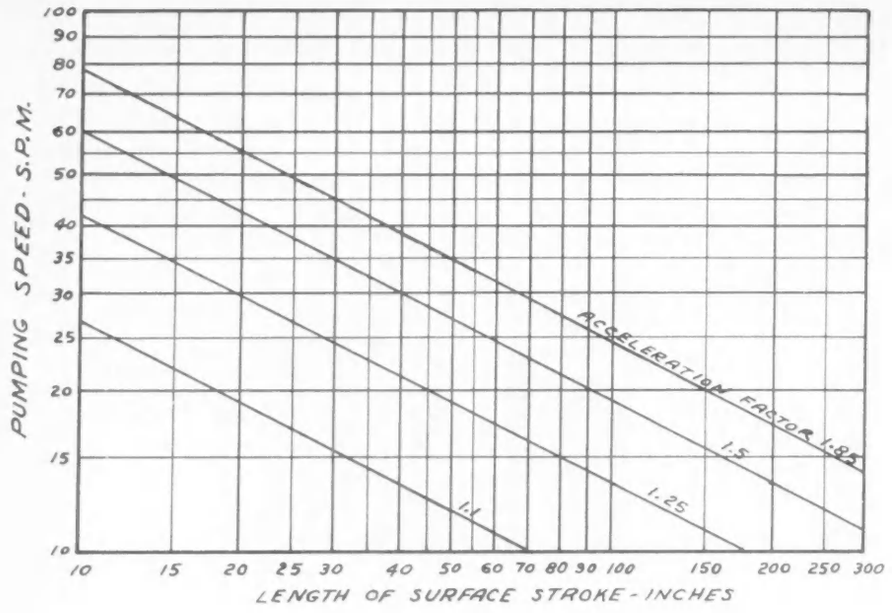


FIGURE 1.

maximum pumping speed at which, if exceeded, the sucker rods will not follow the motion of the surface machinery. If the speed is exceeded, the surface machinery will attempt to place the rod in compression on the down stroke. As the rods will not carry compressive loads without buckling and inducing bending stresses into the rod string, a well should never be pumped above this maximum speed, if good sucker rod life is expected. As this condition will exist when the surface rate of acceleration exceeds the acceleration of gravity this speed can be determined. Experience indicated that the maximum pumping speed for free rod fall can be determined by the equation:

$$N = \sqrt{\frac{60{,}000}{L}}$$

Where:

N = Maximum number of strokes per minute.

L = Length of stroke, inches.

The equation corresponds to an acceleration factor of 1.85. The relationship between speed and stroke for several values of the acceleration factor is shown in Figure 1. Incidentally, for constant fluid and rod loads any of these rates of speed and stroke corresponding to a constant acceleration factor should be given approximately the same rod load, providing the speed is not synchronous with the natural frequency of the rod string.

The rate of polished rod acceleration is not the only limitation on pumping speed if maximum sucker rod life is to be attained. Longitudinal vibrations in the sucker rods can have a pronounced effect on the rod load. These vibrations are induced in the rod string by the opening and closing of the traveling valve, and their frequency is inversely proportioned to the length of the rod string. If the timing of the surface motion is such that the valve action is in phase with the natural frequency of the rod string, severe dynamic stresses may be induced in the rod string. If the timing of the valve action is completely out of phase with the natural frequency of the rod string, the magnitude of these vibratory stresses will be a minimum. As the time intervals between valve actions are not readily controllable with conventional pumping equipment, these dynamic stresses cannot be completely eliminated, but through dynanometer studies they can be held at a minimum. As these vibratory stresses are superimposed on the other stresses existing in the rod string, they reduce its useful capacity and maximum useful work can be attained when they are a minimum. Slonneger[4] suggested the following formula for the natural frequency of longitudinal vibration of the sucker rod string:

$$f = \frac{237{,}000}{D}$$

Where:

f = Natural frequency, cycles/min.

D = Depth to pump, feet.

Experience at medium pumping depths indicates that good sucker rod life is obtained when the ratio of the natural frequency to the pumping speed does not exceed 2.5 and is not an integral number. The minimum value of this ratio should never exceed 1.5. The variations of this pumping speed limit with depth are shown in Figure 2.

The production rate for a given depth and pump size is dependent on the effective plunger stroke and the number of strokes per minute. The net plunger stroke is dependent on the magnitude of the rod and tubing stretch and the plunger overtravel. The magnitude of the plunger overtravel is a function of pumping speed and well depth. The loss of stroke due to rod and tubing stretch is a function of rod and tubing length and area and plunger size; as the stroke loss due to stretch is a problem in elasticity, it is conceivable that in some cases it might be possible to increase production by decreasing the pump size. In these cases the increase in net

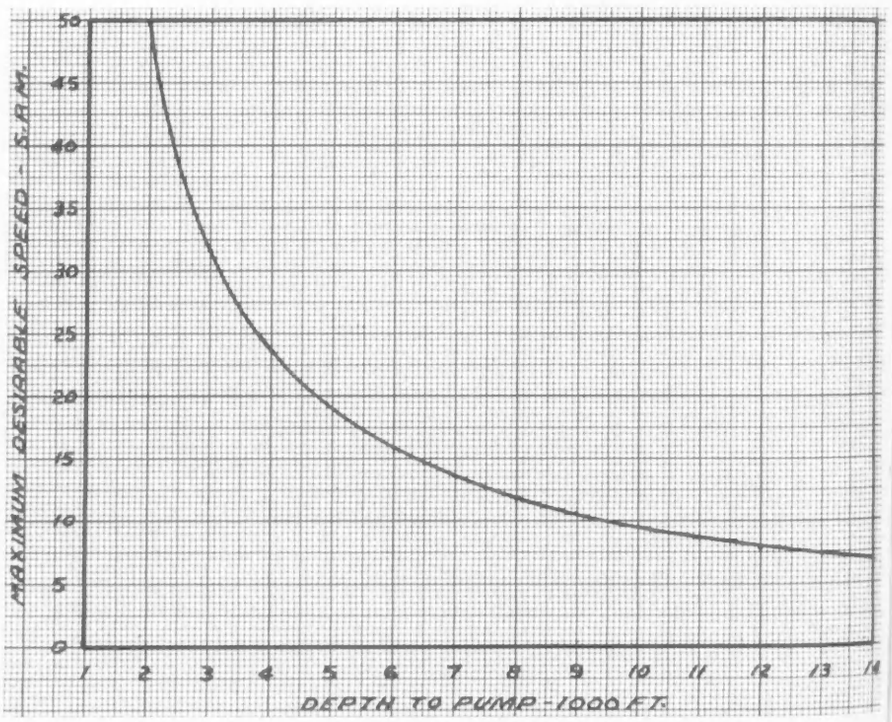


FIGURE 2.

plunger stroke would more than compensate for the loss in plunger area. It was suggested by Coberly[5] that for a given set of pumping conditions, there is an optimum ratio between rod and plunger area which will result in maximum production. The equation for this optimum plunger area can be determined by differentiating the equation for net production considering loss of stroke due to stretch. The equation for the optimum plunger area with the tubing free is:

$$A = \frac{2.88L}{D^2\left(\frac{1}{A_R} + \frac{1}{A_T}\right)}$$

Where:
A = Plunger area, sq. in.
A_R = Area of rods, sq. in.
A_T = Area of metal in tubing, sq. in.
L = Length of surface stroke, inches.
D = Depth to pump, in 1000 ft.

The equation for the optimum plunger area with the tubing anchored is:

$$A = \frac{2.88L\ A_R}{D^2}$$

In these equations the effect of plunger overtravel has been neglected. When it is considered, the length of surface stroke is increased by the amount of the overtravel. Assuming the tubing to be anchored, the optimum plunger area considering overtravel is:

$$A = \frac{2.88\ (L + O)\ A_R}{D^2}$$

Where:
N = Strokes per minute.

$$O = \frac{(ND)^2L}{50{,}000}$$

From these quotations, it is apparent that the plunger area for maximum production is directly proportional to the length of surface stroke and the area of the rods. Also, it is inversely proportional to the square of the depth. Due to the limitations of sucker rod stress, it is not always possible to use a plunger area which will result in maximum production, but these equations indicate that smaller plungers are desirable in deep wells. The ratios of pump diameter to rod diameter for wells of various depths are shown graphically in Figure 3.

As rod stress is the limiting factor in the production of deep wells, it is desirable to understand the relationship between speed, stroke length and production. Assuming a constant size of sucker rod and pump bore, the only variable affecting the magnitude of the sucker rod load is the acceleration factor, which applies only to the weight of the rods. In this case the only variable in the theoretical production rate is the product of pumping speed and the length of surface stroke plus plunger overtravel. As the depth and plunger size are considered constant, the effect of rod and

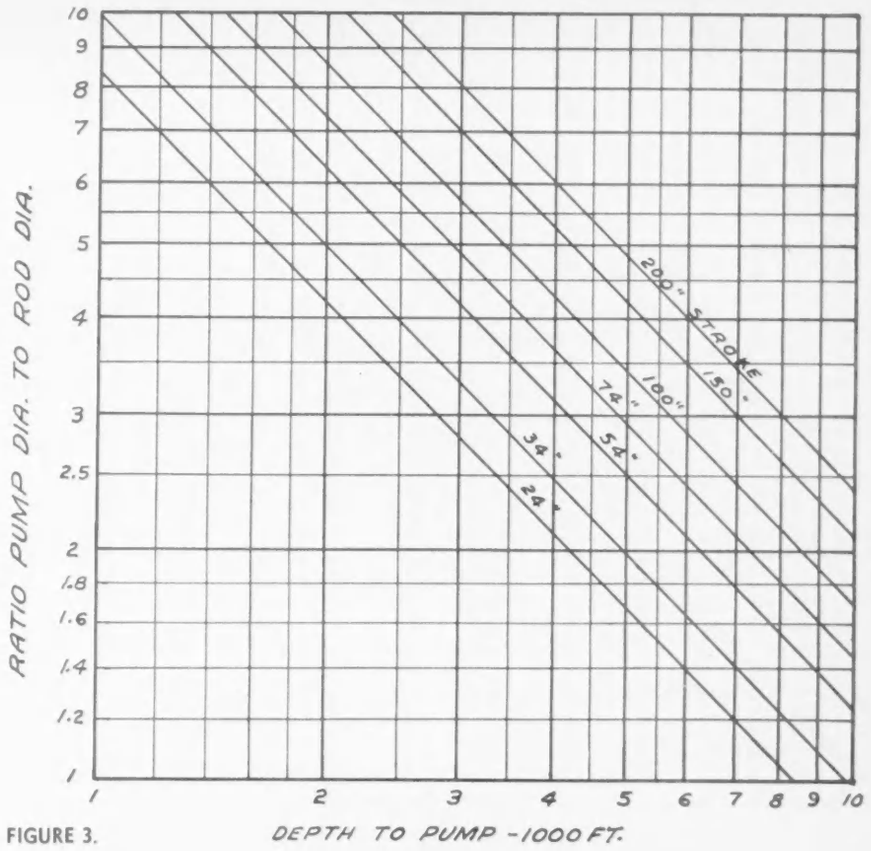


FIGURE 3.

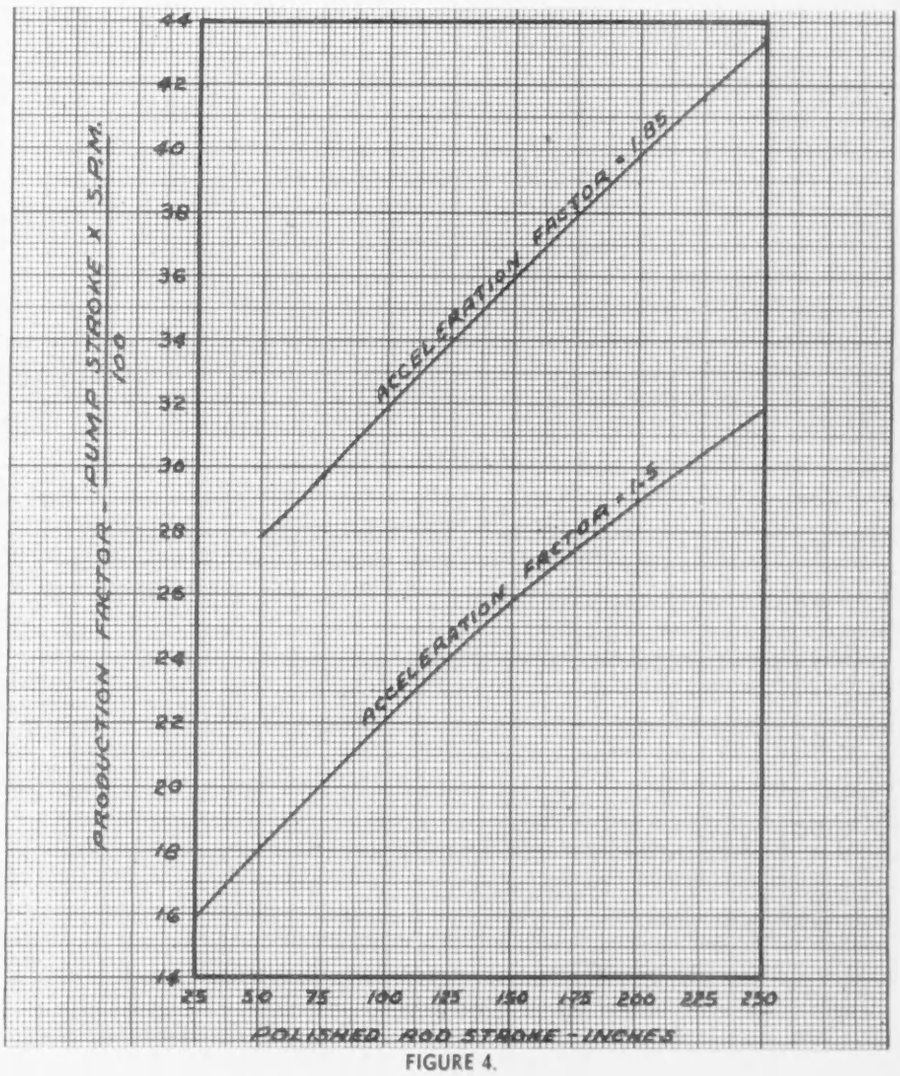


FIGURE 4.

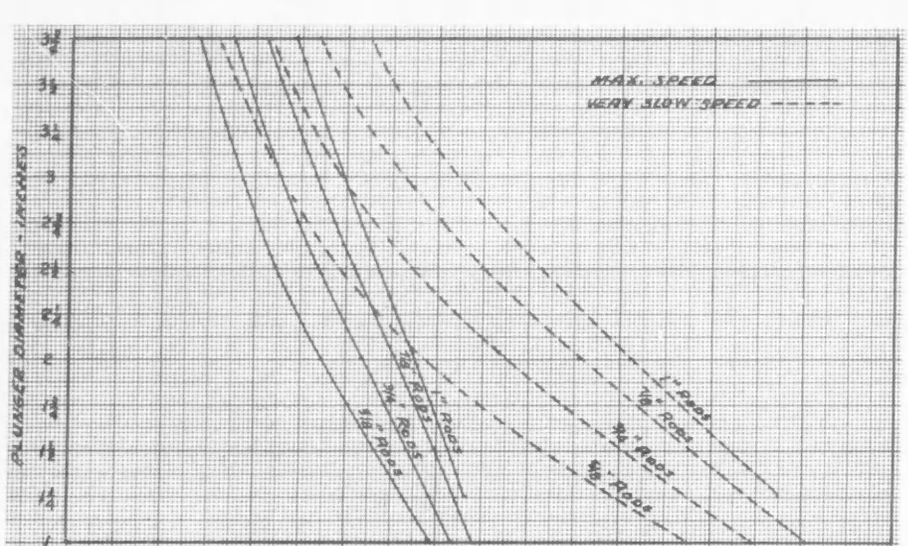


FIGURE 5.

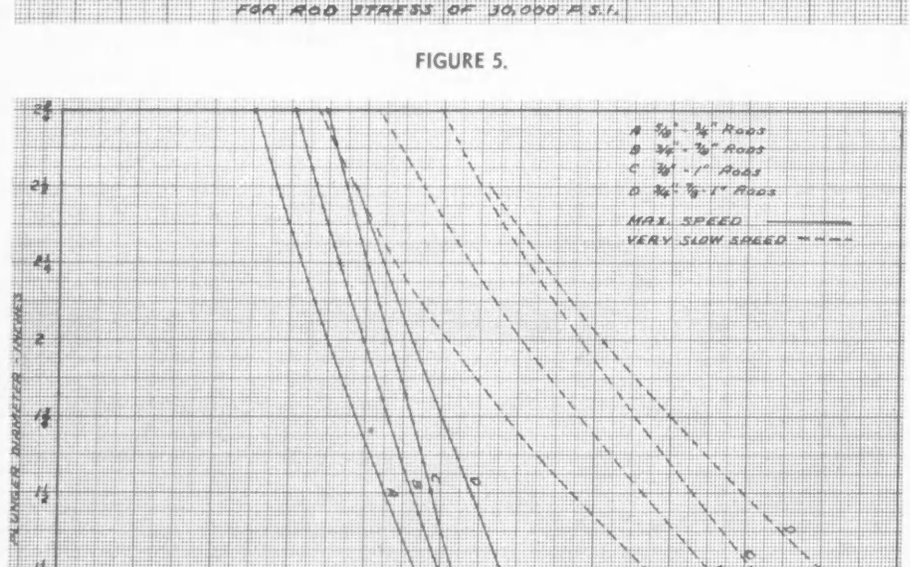

A 5/8" - 3/4" Rods
B 3/4" - 7/8" Rods
C 7/8" - 1" Rods
D 3/4" - 7/8" - 1" Rods
MAX. SPEED
VERY SLOW SPEED
PLUNGER DIAMETER - INCHES
MAXIMUM DEPTH TO PUMP IN 1000 FEET
FOR ROD STRESS OF 30,000 P.S.I.

FIGURE 6.

tubing stretch can be neglected. The relationship between the production factor and surface stroke considering plunger overtravel for two values of the acceleration factor is shown in Figure 4. From this chart, it is apparent that the maximum production for a given rod stress level will be obtained with the maximum length of surface stroke and the minimum rate of pumping speed.

The principal limiting factor controlling the maximum pumping depth is sucker rod stress, and this limit is related to the endurance limit of the sucker rod material. Within limits, this stress can be controlled by proper proportioning of rod size, plunger size, stroke length and pumping speed. The magnitude of the maximum allowable rod stress is dependent on the endurance limit of the rod material and the corrosive nature of the well fluid. As the degree of corrosiveness of the well fluid increases, the sucker rod working stress must be decreased to obtain satisfactory life. The range of pumping depths which can be produced with straight rod strings working at a maximum stress of 30,000 pounds per square inch is shown in Figure 5. The series of curves designated as maximum speed is based on speeds and stroke lengths which result in an acceleration factor of 1.85, and the very slow speeds are based on an acceleration factor of unity; i.e. zero acceleration. The range of pumping depths which can be produced with rod strings tapered for equal maximum stress in each size rod when operating under similar conditions is shown in Figure 6. These curves indicate the obvious facts that, in deep oil well pumping, slow pumping speeds, small plungers, and tapered rod strings are desirable. Also, it indicates that for very deep production, or the production of large volumes of fluid from moderate depths, rod

■ CONTINUED ON PAGE 152

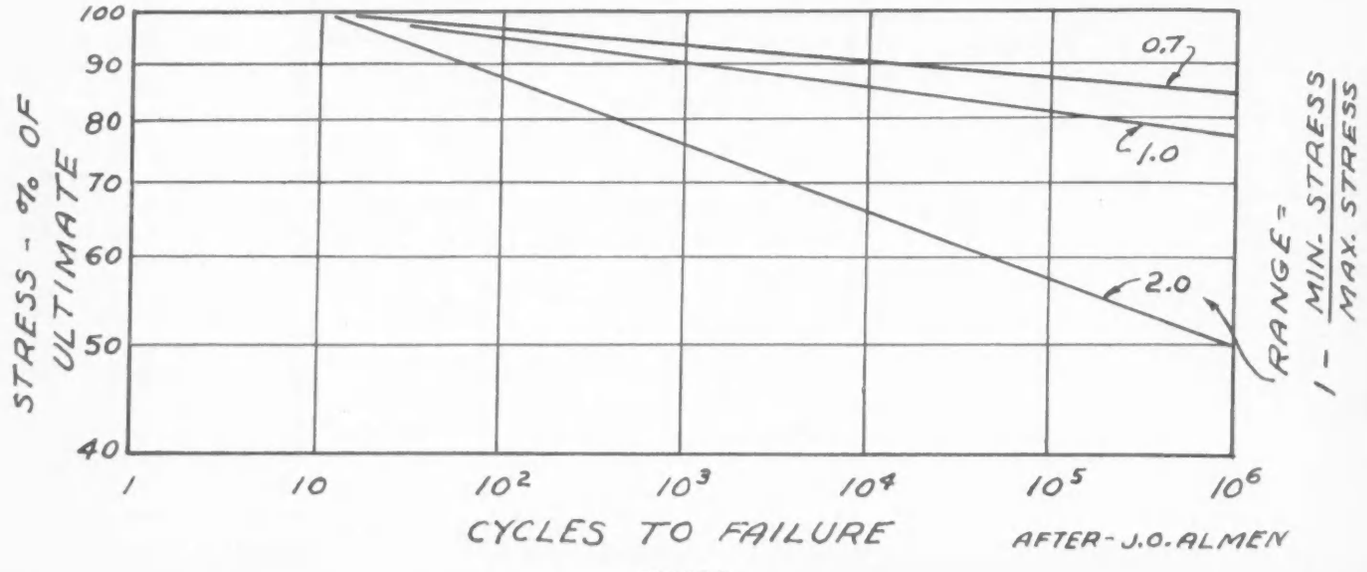


FIGURE 7.

●If it is, Free Pumping is your low-cost answer. The Fluid Power that surfaces and seats your bottom hole pump by the turn of a valve makes light work of paraffin removal. It reduces an expensive operation to a routine chore performed by your pumper while carrying on his regular lease work.

The field photograph above shows the simplicity of removing wax from the production tubing of the Free Pumping system. The pumper is placing a Kobe Soluble Plug in the injector. By directing the oil pressure down the tubing, the plug is forced through the paraffin zone. The wax dislodged from the walls of the tubing by the plug is then pumped out with the production oil. The plug, being soluble in oil, dissolves. It's that easy!

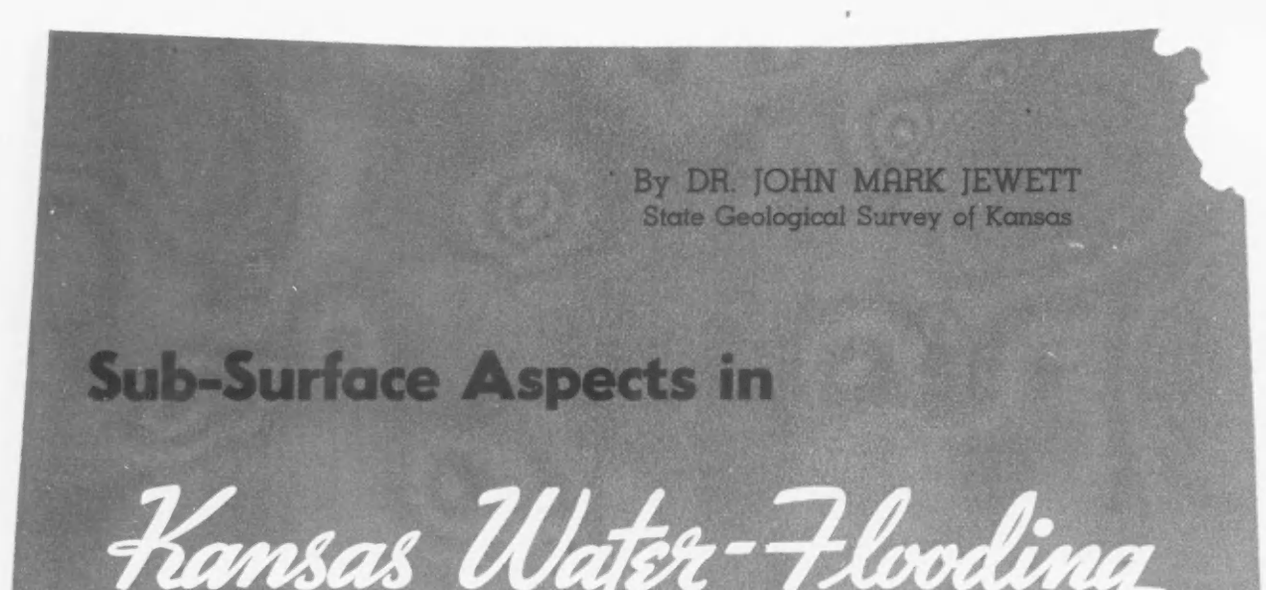
This is just another of the many ways in which Free Pumping reduces your pumping operating costs and helps to maintain your production.

For information about Free Pumping and a simple solution to your paraffin problems, call your local Kobe representative. Do it today!

Free Pump
KOBE
ONE OF THE DRESSER INDUSTRIES

KOBE, INC. *General Offices.* Huntington Park, California, *Division and District Offices.* Avenal, Bakersfield and Ventura, California, Rangely, Colorado, Oklahoma City and Tulsa, Okla., Brownfield, Corpus Christi, Houston, Longview, Odessa and Wichita Falls, Texas, Brookhaven, Mississippi, Hobbs, New Mexico, Great Bend, Kansas, New York City

THESE ARE THE DAYS OF FREE PUMPING



By DR. JOHN MARK JEWETT
State Geological Survey of Kansas

Sub-Surface Aspects in Kansas Water-Flooding

GEOLOGIC ASPECTS of water-flooding operations, now practical in eastern Kansas, are studied with regard to possible adaptation in other areas of the state. The author surveys the situation, and draws on many current studies for his summarization of the prospects. A full bibliography is appended for further pursuit of the subject.

WATER-FLOODING is proving the salvation of the shallow oil industry in eastern Kansas, and it is becoming a phase of consideration of deeper production in central Kansas. Hence it seems well to look critically at this comparatively new and rapidly growing youngster and to determine under what conditions he is being so well nourished. Obviously he is being well taken care of by engineers; but how does the geology of Kansas affect his bringing-up? What are the characteristics of the rocks that bear the oil and through which water is driving the oil?

It is plain that repressuring oil reserves with water demands joint engineering and geologic studies. Some of the geologic aspects are discussed here.

The U. S. Bureau of Mines published a comprehensive history of the earlier water-flooding projects in Kansas Grandone, 1944 (publications to which reference is made are listed at the end of this article), and Abernathy and Jewett (1946) and Jewett and Abernathy (1945) reviewed the situation as of a few years ago. More recently Sweeney (1948) discussed the magnitude of water-flooding projection in the state. Earlier Fancher and Barnes (1936) and Weirich (1937) discussed water-floods in Kansas in papers on projects in the Mid-Continent.

Kansas Water-Flooding's Growth

The first beneficial water floods in Kansas oil sands were accidental, as they had been earlier in New York and Pennsylvania. It was noticed that when water leaked from old wells through corroded casings into oil sands, nearby wells showed a marked increase in production of oil. This led to purposeful floods about 30 years ago. One of the earliest Kansas projects was in the Stanton pool, Miami County, where the "Peru sand" (stratigraphic names not in current official use are enclosed in quotes) is still being repressured by water. In 1935 the Kansas Legislature enacted a law authorizing water-flooding and soon several organized projects were under way in the southeastern part of the state.

Water-flooding projects were organized in Greenwood, Chautauqua, and Linn Counties in 1935, the first year that water-flooding was permitted by law. Water was injected in Pennsylvanian "shoestring sands" at depths ranging from about 400 to 1950 feet. Repressuring by water was still in the experimental stage in 1937 but by that time interest had spread rapidly through the old stripper fields (Weirich, 1937). The next few years saw extensive studies of the engineering and geologic problems involved in repressuring with water, and before the end of 1942 successful projects were in operation in 13 eastern Kansas counties. Some of the fields in which water was being injected had been drilled in the early 1900's. Most of these earliest organized projects are still active. The bringing of know-how into Kansas by operators and engineers from Pennsylvania has been significant.

The State Corporation Commission of Kansas issued 304 permits for water-flooding from 1935 to January, 1948. Sweeney (1948) compiled data on 81 floods in 21 Kansas counties, totaling 10,562 acres in extent and utilizing 2008 injection wells. The total reported production from these projects in 1946 was 3,632,217 barrels of oil produced from 2517 wells. In the shallow stripper areas, comprising the fields in Allen, Anderson, Bourbon, Chautauqua, Douglas, Franklin, Labette, Linn, Miami, Montgomery, Neosho and Wilson Counties, the total primary recovery through 1935 was, according to Sweeney, 110,874,000 barrels of oil. In the period from the beginning of 1936 to the end of 1947, these counties yielded 36,205,000 barrels of oil, and it is estimated that nearly 33 percent of this total was produced by water floods. In 1946, however, approximately 49 percent of the yield in the same area was produced by water floods (Sweeney, 1948, p. 2), and it is judged that at the present time is percentage is considerably larger.

The Cherokee Basin parts of Butler and Cowley counties, and Elk and Greenwood counties, might be regarded as a part of the "shallow stripper" area. The 41 reported water-flood projects in those counties (Figure 1) accounted for a very appreciable part of the 1947 oil production in these four counties.

In any discussion of petroleum production in Kansas it is convenient to classify oil fields into seven structural provinces (Figure 1). As defined by Moore and Jewett (1942) these are (1) The Dodge City Basin (Hugoton); (2) the Central Kansas Uplift; (3) the Salina Basin; (4) the Sedgwick Basin; (5) the Nemaha Uplift; (6) the Forest City Basin; and (7) the Cherokee Basin.

Recently Maher and Collins have shown that Hugoton Embayment is a more fitting term for the northern extension of the large Anadarko Basin than is Dodge City. A basinal area in both pre- and post-Mississippian time, the Hugoton Embayment is of great potential importance and contains the great Hugoton gas field, but it is not now in the repressuring picture. The Salina Basin, annually yielding several hundred thousand barrels of oil, and the Nemaha Uplift, with the famous El Dorado and Augusta pools, have no reported water floods, but it is expected that repressuring will soon be practical.

Older fields in the Central Kansas Uplift are entering the secondary recovery phase. Salt water is commonly being injected through a single input well and one or a few producing wells are being affected. In the Hall-Gurney field, Russell County, the Lansing limestone at 3070 feet is being flooded; in the Smyres field, Rice County, the Mississippian "chat" at 3375 feet; in the Zenith field, Stafford County, the Viola dolomite averaging slightly less than 3800 feet; and in the Silica pool, Rice County, the Arbuckle rocks at about 3300 feet are being repressured with salt water.

The main structural element of the Central Kansas Uplift is a large dome in which Mississippian rocks are absent except on the flanks, and where Pennsylvanian strata rest directly on Ordovician, Cambrian, or locally pre-Cambrian rocks. Chiefly because the strike of anticlinal folds in these pre-Pennsylvanian rocks differs materially from the axis of the uplift as a whole, it has been inferred that the area is the site of an earlier, pre-Mississippian uplift, called the Ellis Arch (Moore and Jewett, 1942). The main features of the Central Kansas Uplift are post-Mississippian in origin. In studying the structural history of oil accumulation in the region and in repressuring it, it is important to differentiate between the ancestral Ellis Arch and the subsequent Central Kansas Uplift.

Sedgwick Basin

The Sedgwick Basin (Figure 1) lies south of the Salina Basin and partly between the Nemaha Uplift and the Central Kansas Uplift. It is designated a separate structural province (Moore and Jewett, 1942, p. 487) partly because it is more or less separated geographically from the continuations northward and westward in contiguous basinal areas, and partly because of the general nature of the geologic structure and production of fields of the region. The Sedgwick Basin is a very important producer of oil, mainly in anticlinal folds located along trends that are generally parallel to those of the Nemaha Anticline.

In Harvey County there are four operating projects in the Hollow-Nickel field. Flooded formations are the Mississippian limestone at 3212 feet and the "Hunton" limestone at about 3500 feet.

There are 12 reported active waterflood projects in McPherson County. Operations are in the Lindsborg field, where the Simpson formation at 3387 feet is being repressured; the Voshell field, with the Simpson at 3413 feet being flooded; the Ritz-Canton field with repressuring in the Mississippian at about 2960 feet; and in the Graber field where the "Hunton" limestone is being flooded at 3300 feet.

Sedgwick County has two reported floods in the Valley Center and Robbins fields. In Sumner County, the Arbuckle limestone at about 2800 feet is being flooded in the Oxford field. In the Churchill field the "Tonkawa sand" (Pennsylvanian) at about 1900 feet is being repressured.

Thinning of Cherokee sediments in a narrow area extending northwestward from northern Bourbon County to northern Lyon or Chase counties indicates that eastern Kansas was briefly separated into two depositional basins, the Forest City in the north and the Cherokee in the south. The low separating structure is the Bourbon Arch (Lee, 1940, Figure 2).

Although this paper is concerned only with the southern part of the Forest City Basin, it should be kept in mind that Pennsylvanian sedimentation seemingly began earlier in the Forest City Basin than in the Kansas part of the

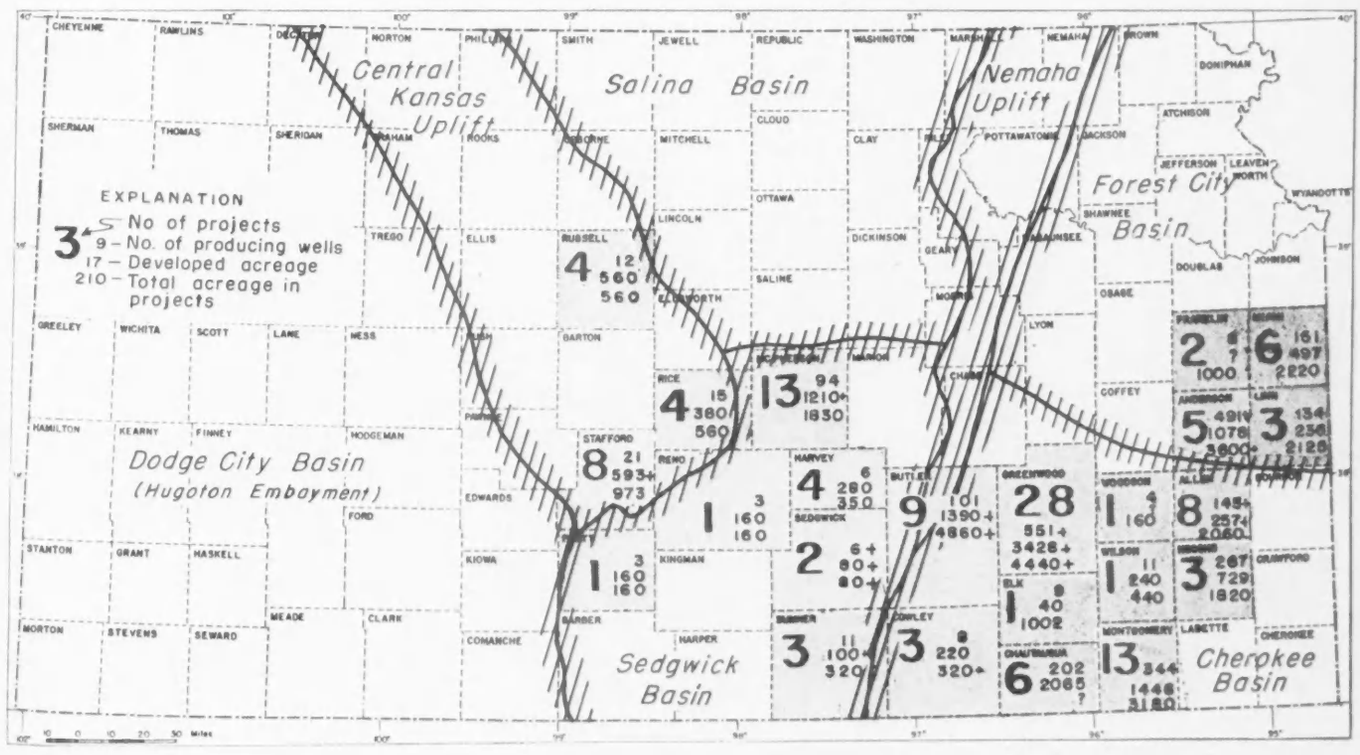


FIGURE 1. Structural provinces in Kansas and distribution of reported water-flood projects.

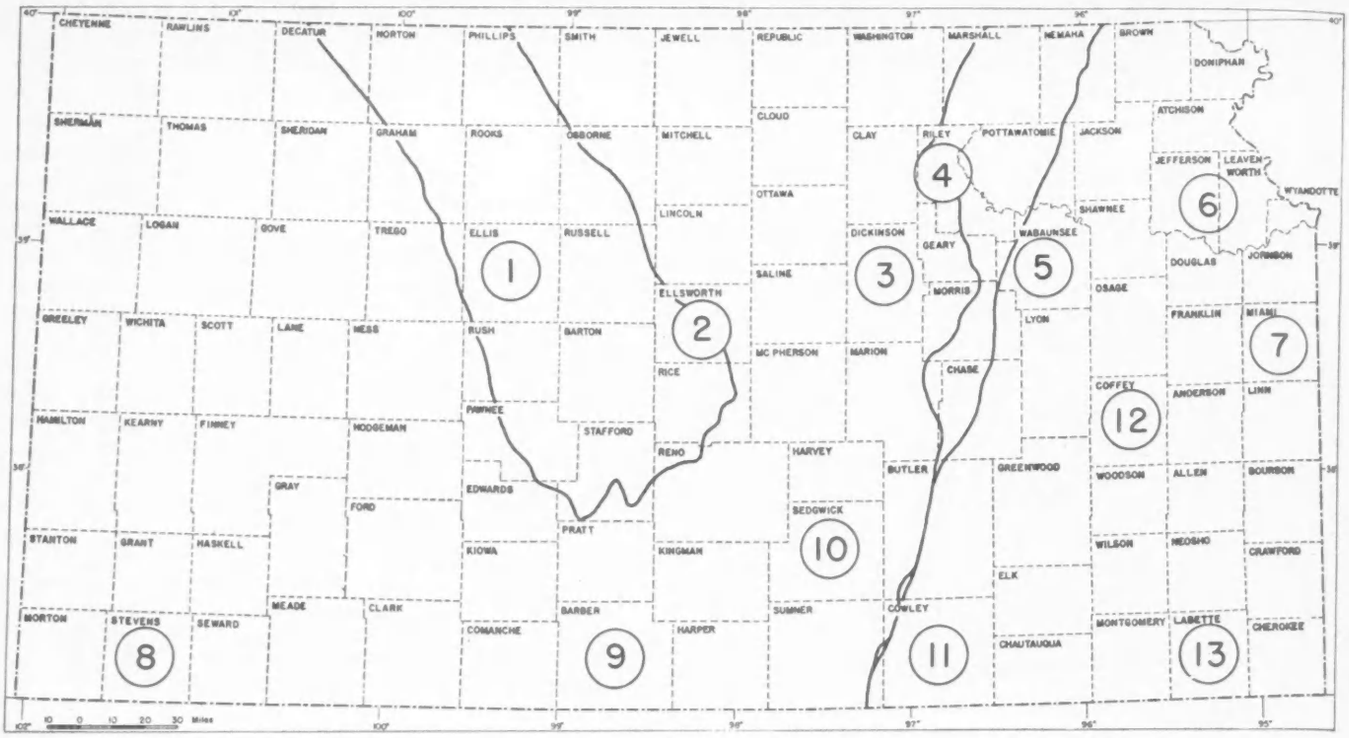


FIGURE 2. Locations of columnar sections in Kansas as shown in Figure 3.

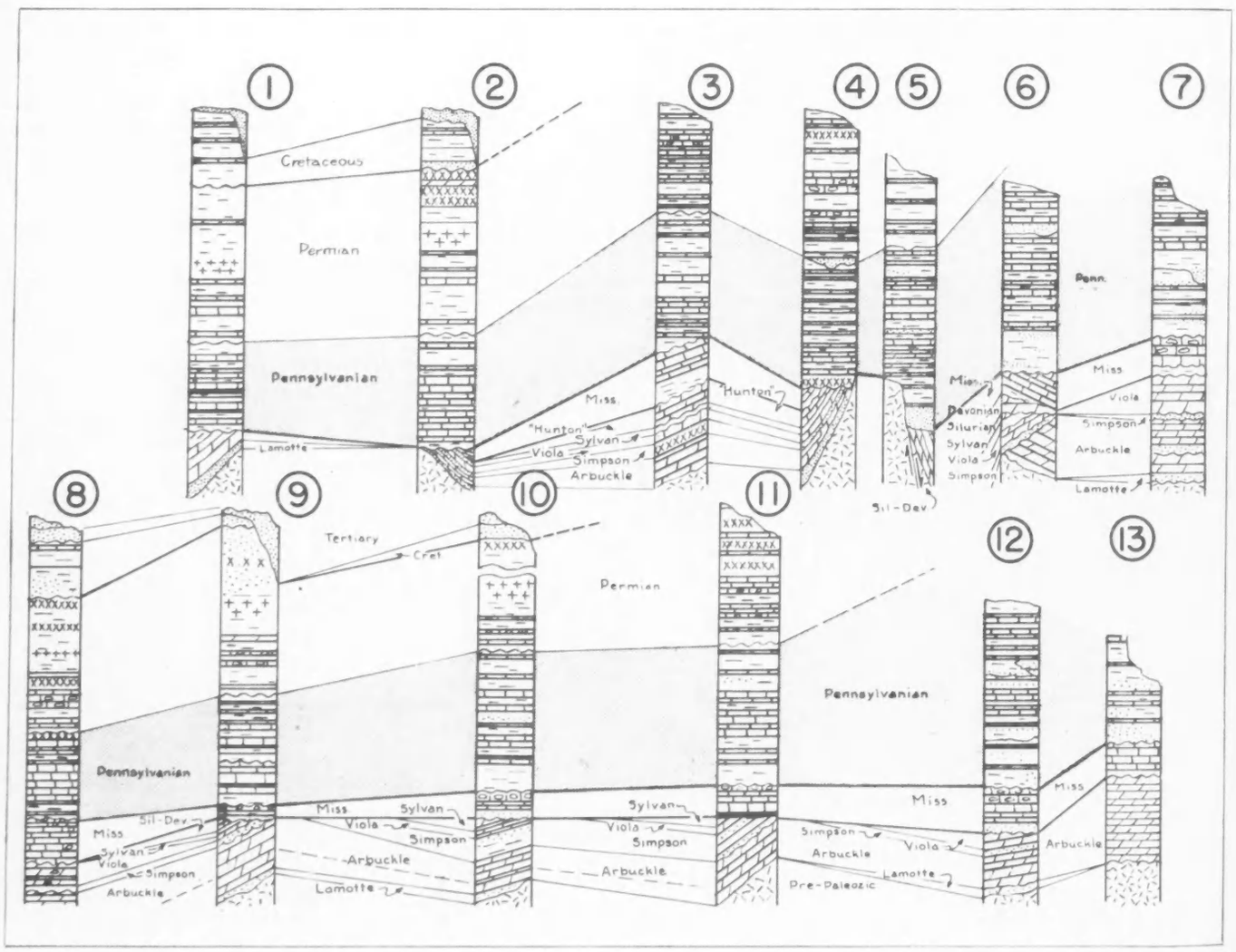
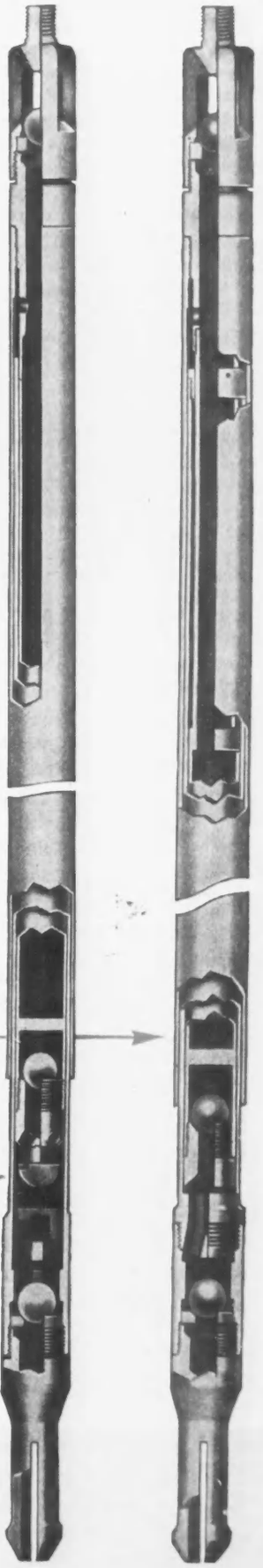


FIGURE 3. Columnar sections showing general nature of rocks in Kansas oil-producing areas. (Modified from Moore and Jewett, 1942.)

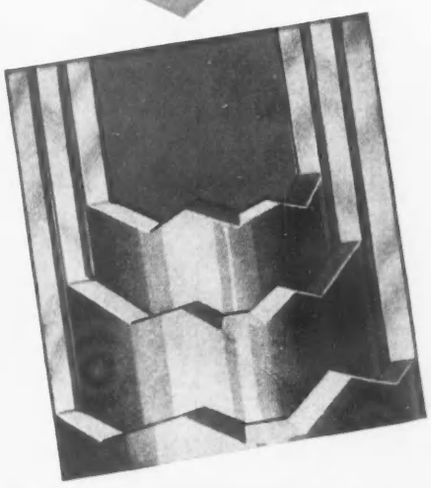
the world's greatest DOWN WELL SAND PUMP

THE oilmaster MULTIPLE TUBE Fluid Packed Pump



It's all a matter of construction . . .

7 to 15 times greater space for abrasive sand particles to pass through the pump without scoring the metal surface. 7 to 15 times more fluid cushion between the working parts to protect them against wear make it the favorite of production men in every hard-to-pump field in the world.



The POSITIVE PULL TYPE is recommended for general pumping conditions wherever the insert feature is desired. The entire assembly is installed and removed on the rod string.

The REMOVABLE TYPE is equipped with a manually operated hook-on device which makes removal of the standing tube and standing valve optional when the traveling tubes are pulled.

Illustration at left shows fluid packing in color. It is actually the fluid being pumped.

FLUID PACKED PUMP COMPANY • LOS NIETOS, CALIFORNIA

EPPCO OILMASTER PRODUCTS

DISTRIBUTED BY THE NATIONAL SUPPLY CO.
EXPORT: THE NATIONAL SUPPLY EXPORT CORP.,
30 ROCKEFELLER PLAZA, NEW YORK, NEW YORK

CO-DISTRIBUTORS: BERRY SUPPLY STORE, BEACON SUPPLY COMPANY, INDUSTRIAL SUPPLY COMPANY

Cherokee Basin. Hence, one expects to find differences in the character of oil sands in the two areas—especially in those in the Cherokee Rocks. There is evidence, too, that later in Pennsylvanian time some of the sediments north of the Bourbon Arch came from a different direction than from whence came those in the Cherokee Basin. Waterflood operators should remember that when they cross the Bourbon Arch they are in another petroliferous province.

In Anderson, Franklin, Linn, and Miami counties the oil fields are old and production is in shallow Pennsylvanian sandstones, which are discussed in a later section of this paper with other reservoir rocks.

The number of reported water-flooding projects, number of producing wells, and developed and undeveloped acreage in these counties are shown in Figure 1. Annual oil production in the Forest City Basin exceeds 1 million barrels. The "Big Lake," "Squirrel," and "Bartlesville sands" are being repressured in the large operations.

Water-flooding has become extremely important in the oil-producing counties of the Cherokee Basin (Figure 1), an area that annually yields more than 10 million barrels of oil. There, as in the Forest City Basin, were it not for successful repressuring the oil production would be expected to decline rapidly. Although some production is from Ordovician and Mississippian rocks, most of the oil is produced from Pennsylvanian sandstones and the fields mostly are in the stripper stage. Mississippian reservoirs are being repressured but most of the flooding operations are in Pennsylvanian rocks, especially the "Bartlesville sands."

All the area of the Cherokee Basin except the northern parts of Butler and Greenwood counties lies also on the pre-Mississippian Chautauqua Arch—an area in which erosion removed whatever sediments of Devonian, Silurian, and Upper Ordovician age that were present, before deposition of the Chattanooga shale (Late Devonian or Early Mississippian). In this area Arbuckle rocks are flanked on the north and northwest by bands of successively younger Ordovician formations. The comparatively narrow band of the pre-Chattanooga outcrop of Simpson sandstone (St. Peter) is commonly regarded as marking the boundary of the Chautauqua Arch (Moore and Jewett, 1942, Figures 6, 7; Jewett and Abernathy, 1945 Figures 3, 4). This is mentioned briefly here because of the importance in studying the structural history of oil accumulation and especially because of conditions affecting water supplies for repressuring projects.

Characteristics of Reservoir Rocks

Kansas petroleum-bearing rocks through which injected water drives oil to the producing wells may be classified into three general types but each includes strata of several characteristics. These classes are: (1) limestone and dolomite, (2) sandstones, and (3) coarse detrital rocks such as the Mississippian "chat." The principal limestone reservoirs are the Arbuckle limestone, the Viola limestone, the "Hunton" limestone, the Mississippian limestone, the Lansing formation, and other Pennsylvanian limestones. The important sandstones being flooded are those of the Pennsylvanian section, especially in the Cherokee shale, and the Simpson (St. Peter) formation.

A majority of the producing oil reservoirs in Kansas are of the limestone and dolomite type, but this type of reservoir rock is now secondary to sandstone in water-flooding considerations. Occurrence of oil in limestone and dolomite is controlled by irregular porosity by solution or weathering prior to the accumulation of the oil and perhaps in part by processes of dolomitization.

The Arbuckle, Viola, "Hunton," Mississippian, and Lansing limestones are each composed of several formations having their own lithologic characteristics, and the processes that may have induced porosity varied from locality to locality. Attention is called to the fact that in general reservoirs are closely below disconformities and that the "tops" of units as Mississippian limestone or of the Arbuckle are different in different oil fields. In general the voids in porous limestone are much larger than in sandstones but the porosity is not necessarily greater. Acidizing in limestone and dolomite reservoirs to increase the porosity is an important consideration.

The geologic literature contains many excellent discussions of limestone reservoirs in Kansas. The long list of such papers cannot be included here but attention should be called to studies of the Mississippian limestones by Wallace Lee (1940) and by Joseph R. Clair (1948).

"Chat" is a much-used term for deposits of fragmentary chert and other debris overlying Mississippian limestone.

TABLE 1

Chemical analyses of representative waters produced from Kansas oil fields[1, 2]

FORMATION	POOL	COUNTY	Location Sec.	T.	R.	Depth to Horizon	Sp. Gr. (60° F.)	Magnesium (Mg)	Sodium (Na)	Calcium (Ca)	Chloride (Cl)	Sulfate (SO_4)	Bicarbonate (HCO_3)	Bromide (Br)	Iodide (I)	Aluminum (Al)	Iron (Fe)	Total Solids
Hoover	Oxford	Sumner	14	32	2E	1700	1.140	2515	67500	9415	131874	1400	36	280	2	290	8	213300
Stalnaker	Oxford	Sumner	14	32	2E	2100	1.155	2620	71100	11100	141072	**	24	120	2	710	12	226800
Kansas City-Lansing	Madison	Greenwood	5	23	11E	1060		1351	33812	3443	63333	76	109				12	103700
Kansas City-Lansing	Silica	Rice	27	19	10W	3200	1.108	3492	52420	8085	109806	**	82	130	*	864	*	174900
Kansas City-Lansing	Hall-Gurney	Russell	31	14	13W	2950	1.114	3075	55300	11100	117825	200	48	70	10	51	1	187700
Layton	Oxford	Sumner	14	32	2E	2400	1.158	3960	75000	11820	152162	**	72	180	2	321	3	243500
Peru	Sedan	Chautauqua	12	33	10E	1400	1.090	1840	40500	6910	82962	**	54	90	4	115	5	132500
"Bartlesville sand"	Madison	Greenwood	14	22	11E	1900	1.052	900	25150	3065	49223	**	180	40	2	**	*	78600
"Bartlesville sand"	Eastman	Butler	6	31	6E	2850	1.100	1330	52000	5600	98098	**	54	40	5	190	3	157300
"Bartlesville sand"	Frog-Hollow	Cowley	20	32	5E	3000	1 140	2060	46000	14680	165494	50	18	60	*	230	8	228600
"Chat"	Ritz-Canton	McPherson	19	19	1W	2900	1.079	7004	40560	4070	72578	50	73	45	2	**	*	117960
"Chat"	Burton	Reno	15	24	4W	3400	1.115	2180	66652	9200	129015	**	60	247	*	525	1	207880
"Chat"	Halstead	Harvey	2	23	2W	3000	1.070	794	34770	3350	61700	**	130	150	*	142	2	101250
Mississippian limestone	Stephenson	Woodson	7	24	14E	1700	1.037	514	16500	2340	32107	125	264	20	*	49	1	51900
Mississippian limestone	Virgil	Greenwood	11	24	12E	1750	1.037	700	16700	2180	32441	**	254	5	*	**	*	52300
Mississippian limestone	Beaumont	Greenwood	25	27	8E	2510	1.091	1857	44550	6780	89009	175	96	10	3	**	*	142500
"Hunton" limestone	Elbing	Butler	20	23	4E	2370	1.020	320	8500	990	16195	725	300	10	*	**	*	27000
"Hunton" limestone	Graber	McPherson	20	21	1W	3300	1.044	751	21090	2327	40090	**	96	*	*	133	3	64300
"Hunton" limestone	Sperling	Harvey	13	22	2W	3305	1.031	253	14150	1260	25000	100	120	65	*	**	*	41300
Viola limestone	Greenwich	Sedgwick	14	26	2E	3100	1.020	204	7800	755	14320	**	501	*	*	**	*	23600
Viola limestone	Hillsboro	Marion	28	20	2E	3037		271	5284	597	10000	15	79					16400
Viola limestone	Ritz-Canton	McPherson	20	19	1W	3000	1.030	404	11980	1803	22990	75	233	15	*	**	*	37400
Simpson	Valley Center	Sedgwick	1	26	1E	3390	1.040	628	17830	1900	32965	90	250	80	*	**	*	53600
Simpson	Ritz-Canton	McPherson	21	19	1W	3440	1.015	235	5560	892	10874	80	184	*	*	**	*	17700
Simpson	Zenith	Reno	7	24	10W	3607	1.055	1150	26170	4150	51533	**	230	45	*	**	*	83300
Arbuckle	Chase	Rice	21	19	9W	3250	1.017	288	7520	994	14090		507	5	*	**	*	23400
Arbuckle	Silica	Barton	1	20	11W	3200	1.020	287	7900	1041	14916		181		*	**	*	24300
Arbuckle	Hall-Gurney	Russell	24	14	13W	3200	1.027	600	10900	2095	23031	650	269	15	*	**	*	37600
Arbuckle	St. Johns	Stafford	28	24	13W	4200	1.035	500	10230	2335	32207	2200	378	*	*	**	*	47900

[1] Data from Schoewe, 1943. [2] All chemical analysis in milligrams per liter. To convert to parts per million, divide by specific gravity of the brine. * Denotes a concentration of less than 1 milligram per liter; ** Denotes a concentration of less then 25 milligrams per liter.

It is common to speak of the "Mississippian chat" but undoubtedly these deposits locally are only slightly older than the overlying Pennsylvanian rocks and probably all or most of them are of Pennsylvanian age. The chert is generally much weathered and deeply stained by iron oxide, and the fragments are intermingled with deeply oxidized ferruginous clayey material. This kind of rock accumulation in Marion, McPherson, Reno, Rice, and Ellsworth counties has been shown definitely to be of Pennsylvanian age and is called the "Welch chert." One water-flood project, in the Smyres field, Rice County, is reported with "chat" as the producing formation. Pennsylvanian basal conglomerate and Sooy conglomerate are terms used for basal Pennsylvanian beds composed largely of debris from nearby Pre-Cambrian areas, and are important oil reservoirs in several western Kansas fields.

As water-flooding becomes more common in coarser detrital rocks, new problems will be encountered.

It is in the Pennsylvanian sandstone reservoirs that repressuring with water is most extensive. Knowledge of Kansas Pennsylvanian sandstones is far from complete, but much progress can be reported. It may be pointed out that problems arising in conjunction with water-flooding projects emphasize the practical importance of some geologic studies that superficially seem to be purely academic.

Accumulating data on cyclical deposition of Pennsylvanian rocks has an important bearing on studies of fluid reservoirs. The origins of these sandstones were diverse. Most of the sediments comprising the present shales, limestones and sandstones came from the south but in some areas, as in the Forest City Basin, at least some of the deposits came from the north or east. Sorting of sand from finer particles was largely local—that is, after great quantities of clay, silt, and sand were brought into the depositional basins, waves and running water reworked much of the material and in part separated sand from clay. Sand was subsequently deposited as lenticular bodies, some of which are the "shoestring sands" of the oil fields. Some "shoestring sands" are believed to be channel fillings (Charles, 1927; Jewett, 1945), and some offshore bars (Bass, 1936). The "shoestring sand" bodies generally are more free from clay partings than are the more nearly sheet-like deposits. Locally, cross-bedding is characteristic of sandstone deposits in most of the Pennsylvanian rocks. Because of cross-bedding one expects water to travel at different rates in different directions. Few sandstone bodies are homogeneous from top to bottom; hence fluids are transmitted at different velocities at different levels. Because of the probability of cross-bedding and other directional properties, oriented cores are useful for laboratory studies.

Classification and brief descriptions of outcropping Kansas rocks, including the exposed equivalents of most of the oil sands, are contained in Kansas State Geological Survey Bulletin 52, pt. 4 (Moore, Frye, and Jewett, 1944). Brief discussions of the oil-producing sandstones in eastern Kansas are included in Kansas Survey Bulletin 57 (Jewett and Abernathy, 1945) and oil sands of specific areas are described in many publications too numerous to be listed here. Some of the Pennsylvanian sandstones that are of more importance in reference to water drive in Kansas are discussed below.

Elgin Sandstone

The Elgin sandstone occurs in the upper part of the Kanwaka shale, the formation first below the Oread limestone. The sub-surface equivalent or near equivalent of the Elgin often is called the "Hoover sand." The Elgin is an important water-bearing rock in several parts of eastern Kansas.

The name "Big Salt sand" is used to designate sandstone bodies in the Douglas and probably Pedee groups in southern Kansas. Sandstone comprises an important part of the sediments that constitute the Douglas (lowermost Virgilian) and a lesser part of the Pedee (uppermost Missourian) rocks. A major erosional break separates deposits of the two ages and locally lower Virgilian sand occupies channels cut into upper Missourian deposits; locally two sandstone bodies are in direct contact or Virgilian sandstone is in contact with Lansing beds.

The term "Stalnaker sand" is used for an oil-producing sandstone in Cowley and eastern Sumner counties. It occupies a position in the uppermost part of the Lansing group or in the Pedee group. Its depth in the Falls City field, Cowley County, where it is productive, is about 2000 feet, in Sumner County in the Churchill field about 1900 feet, and in the Oxford field about 2020 feet. The "Stalnaker" is a sheet-like sand body, locally containing shale breaks, throughout most of Cowley County and eastern Sumner County. It is probable that in part sandstones that are called "Big Salt" and "Stalnaker" are equivalent formations. The "Tonkawa sand" of northern and central Oklahoma is probably the same as the "Stalnaker," and in southern Kansas the two names are used interchangeably.

In Elk County, three sandstones in the Vilas shale, Lansing group, bear oil. The upper sandstone is known as the "Bush-Denton" or "Ferguson," the middle one as the "Longton" or "Webb," and the lower one as the "Encill sand."

"Layton" and "Cleveland" sands are widely used names for sand bodies in the Coffeyville formation. These, although broadly lenticular, are to be regarded locally as more or less sheet-like deposits of probable deltaic origin. The "Layton," at about 2300 feet, is productive in the Turner and Winfield fields, Cowley County. The name "Layton" is used in some places for one or more sandstones that are somewhat higher stratigraphically than the Coffeyville rocks.

The "Big Lake sand," which is being flooded in the Big Lake field, Miami County, is believed to be in part the Hepler sandstone (lowermost Missourian) and in part the Bandera Quarry sandstone ("Weiser" in the sub-surface in southern Kansas). The Bandera Quarry sandstone occupies a position in the Bandera shale, Marmaton group. In parts of Miami County, pre-Missourian erosion seemingly removed upper Marmaton rocks and the Hepler sandstone subsequently was deposited on the lower sandstone. The "Big Lake" is a "shoestring" sandstone having a northeast-southwest trend.

"Wayside" is a common designation of sandstone bodies that occur in the Nowata shale, which lies below the Le-

TABLE 2

Chemical analyses of some samples of deep ground water in southeastern Kansas (in parts per million)[1]

FORMATION	Location Sec.	T.	R.	Na	Ca	Mg	Fluorine	SO_4	Cl	HCO_3	SiO_2	Alkalinity as $CaCO_3$	Carbonate Hardness	Total Hardness	Total Solids	Turbidity
Lamotte sandstone	17	31S	21E	24,820	6,700	975	....	1,180	52,100	101	....	.....	.....	.....	.....	.....
Reubidoux formation	13	33S	23E	121.0	41.0	22.0	1.3	35.0	39.0	438.0	6.0	359.0	193.0	193.0	477.0	10.0
Cotter dolomite	17	35S	17E	5,800.0	469.0	163.0	....	30.0	9,842.0	662.0	....	.....	.....	.....	16,966.0	....
Mississippian rocks	8	28S	11E	33,860.0	4,731.0	1,791.0	....	4.0	65,786.0	27.0	....	.....	.....	.....	106,199.0	....
Mississippian rocks	9	28S	12E	29,608.0	3,429.0	2,162.0	....	0.0	58,016.0	15.0	....	.....	.....	.....	92,230.0	....

[1] Data from Abernathy, 1948.

napah limestone and above the Altamont limestone. The name was first used for the oil-producing rock in the Wayside field, Montgomery County. "New Albany sand" is used for the same producing zone. This name came from the New Albany field, Elk County. Farther north, as in Anderson County, the name "Wayside" is often used for a stratigraphically lower sandstone in the Bandera shale which is equivalent or nearly equivalent to the "Weiser sand."

The "Weiser sand" occurs in the Bandera formation. Throughout much of its occurrence in the sub-surface in eastern Kansas and in its outcrop belt, the Bandera contains much sandstone, partly in lenticular bodies, partly in wedge-like, and partly in "shoestring-like" deposits. The Weiser is of considerable importance as an oil reservoir in Chautauqua and Montgomery counties; equivalent or near-equivalent sandstones yield oil in several eastern Kansas counties.

The "Peru sand" lies in the Labette formation, between the Pawnee limestone (above) and the Fort Scott limestone (below). The name is widely used in eastern Kansas oil fields. In the Peru-Sedan area, Chautauqua County, the Peru has an average thickness of about 25 or 30 feet and lies at a depth of almost 1200 feet.

Sandstones in the Cherokee rocks, lowermost Pennsylvanian in eastern Kansas, are the most important oil-producing rocks of that part of the state. Several names of sandstones are in current usage and most or all of them have been used for different formations. Sandstone beds called "Squirrel sand" commonly occur in the upper part of the Cherokee. The sandstones are gas and oil reservoirs in several eastern Kansas counties, especially Franklin, Linn, and Miami. The Squirrel, where present, is commonly about 30 feet below the Fort Scott limestone or the top of the Cherokee shale. Its thickness locally is as much as 80 feet. The sandstone is commonly shaly and irregular. Locally, as in the Pressonville field, Franklin and Miami counties, distinct "shoestring sands" occur in the "Squirrel" zone.

"Cattleman sand" is the name used in Greenwood County for sandstone bodies in the upper middle part of the Cherokee section, 50 to 75 feet above what there is called "Bartlesville." The "Cattleman" occurs in more or less isolated lenses.

"Burbank sand" is a term applied locally to sandstones in the middle part of the Cherokee and the name "Bartlesville sand" commonly is applied to sand bodies in the middle and lower parts. In local usage there may be an "upper and lower Bartlesville." Sandstone that lies a few feet above or on Mississippian limestone generally is called "Burgess," or in some places lowermost Cherokee sandstone is called "Tucker." Inasmuch as lowermost Cherokee sediments are of different ages in different places it follows that this succession of names is applied to different rock sections.

Bass (1936, p. 27) has shown that productive sandstones in Greenwood, Butler, Cowley, and other Kansas counties commonly called "Bartlesville" would be more nearly correctly called "Burbank." However, the term Bartlesville when used locally generally is well understood. Studies indicate that Bartlesville shoestring sands of the several trends in southern Kansas were deposited at about the same time, but some are slightly older or younger than others. For example, Bass (1936, p. 68), concluded that the main sand body of the Seeley field is older than that of the Wick and Burkett fields.

The sand bodies of the Bartlesville shoestring oil fields may be as much as 100 feet or more in thickness, but the common thickness for the central parts of most fields is about 50 feet. For example, the sand body of the Seeley field, Greenwood County, is as much as 90 feet thick in parts of the field; the sand bodies in the De Malorie-Souder and Madison fields are more than 100 feet thick in some parts. Commonly there is more shale in the margins of the bodies than in the central and thicker parts. It is not unusual to find beds of sand a few feet thick separated by a few inches of shale, some of which may be thinly laminated and sandy or carbonaceous.

In several fields the lower parts of the shoestrings contain pebbles of chert up to one-half inch in diameter, but as a whole the bodies are composed of fine and very fine sand (1/16-¼ mm.). In some the lower parts contain coarse or very coarse sand (½-2 mm.). As a rule the bodies may be from 15 to 30 percent silt and clay.

The brief description of "Bartlesville sandstone above pertains mostly to shoestring bodies. However, the Bartlesville in some fields, as in Montgomery County, occurs in broad lenses and may be regarded locally as sheet-like sand bodies. The Bartlesville and other sandstones have their individual characteristics in the various oil fields. Bass's report (1936) should be of great interest to water-flood operators, especially in Butler and Greenwood counties, and his discussions of the shapes of sand bodies and of the physical characters of the sand serve to point out some of the conditions that one may expect in other areas of Bartlesville production.

Water Available For Repressuring

Many recently published articles emphasize the importance of the quality of water used in repressuring (Abernathy, 1948; De Lozier, 1947; Terwilliger and Yuster, 1947; WORLD OIL, 1947). There is also much information available on the quality and quantity of water available for flooding in Kansas (Abernathy, 1948; Schoewe, 1943; see also Kansas Geological Survey bulletins on groundwater in various counties), but it is scattered through many publications. Some analyses and other data are presented in this section.

In 111 projects in 24 Kansas counties recently surveyed by Sweeney and Lilley, 78 are being repressured with salt water, 14 with fresh water, and 9 with combined fresh and salt water. In one project "lime water" (Allen County) and in one Mississippian H_2S water (Montgomery County) were reported by the operators. No information on the quality or source of water for eight projects is at hand. Sources of salt water include the Big Salt Sand (Douglas-Pennsylvanian), Stalnaker sand (upper Lansing-Pennsylvanian), Layton sand (upper Coffeyville-Pennsylvanian), Bartlesville sand (Cherokee-Pennsylvanian), Mississippian limestone, Viola and Simpson formations (Ordovician), and Arbuckle limestone (Cambro-Ordovician). Sources of fresh water include shallow sandstones and limestones, lakes, rivers, and municipal water supplies. Where combined fresh and salt waters are used, the brine is obtained commonly from the oil-producing formations. Salt water from the deeper formations, Viola, Simp-

About the Author

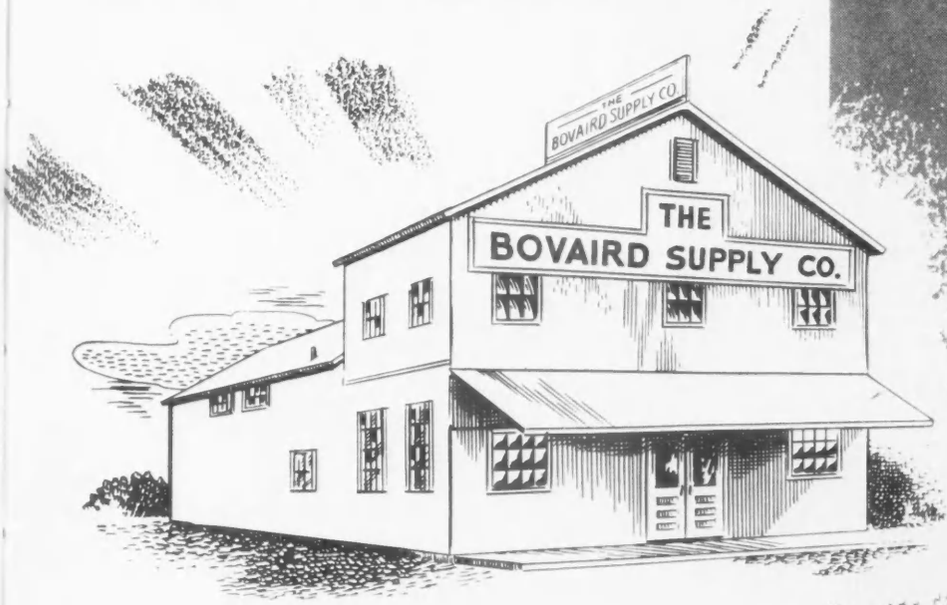
DR. JOHN MARK JEWETT is geologist in charge of the Division of Stratigraphy and Paleontology, State Geological Survey of Kansas, University of Kansas, Lawrence. A native Kansan, he has spent much of the last two decades investigating Kansas geology, principally Pennsylvanian and Permian stratigraphy. Geology of coal, oil, and gas in eastern Kansas and eastern Kansas ground-water resources and the application of stratigraphy to engineering projects and mineral developments come within the scope of his activities.

Where there's a Well THERE'S A WAY....
TO FILL YOUR SUPPLY NEEDS

Just Call BOVAIRD...

Every Bovaird Supply Store is fully stocked with the oil field equipment necessary to insure success in your operation—whether in the drilling, producing, pipe line or refining field.

Bovaird stores are strategically located throughout the oil states of Illinois, Oklahoma, Kansas and Texas—each one ready to serve you efficiently and courteously.



"Buy From Bovaird"

OFFICES AND STORES

ILLINOIS—Clay City, Grayville, Salem
KANSAS—Chase, McPherson, Pratt, Russell, Wichita
OKLAHOMA—Duncan, Oklahoma City,
Pauls Valley, Sapulpa, Seminole
TEXAS—Borger, Dallas, Odessa, Pampa

SUPPLY BOVAIRD COMPANY

THE BOVAIRD SUPPLY CO.

GENERAL OFFICES: TULSA, OKLAHOMA

son, and Arbuckle, is used principally in western Kansas counties (Figure 1).

In eastern Kansas counties, according to a recent survey (Abernathy, 1948), 24 water-flood projects are using fresh water and 30 are using brines.

Of 78 users of salt water in Kansas, 14 are treating the brines. Treatment includes aeration, addition of chemicals, settling, and filtration singly or in various combinations. Of 14 users of fresh water, nine are treating the water and five are not. Treatment of fresh water includes adding limes, chlorine, alum, and settling and filtering. Eight of nine operators who reported the use of fresh and salt water combined reported that the water is being treated.

Some Kansas water-flood operators inject water under pressures of 900 or more pounds per square inch at the wellhead; others are not increasing pressures due to gravity. Obviously, characteristics of the reservoir rocks are important factors. In some projects higher pressures are obtained in order to make oil wells flow. In some projects as much as 45,000 barrels of water is injected daily.

It is plain that a major requirement of successful water flooding is an adequate supply of water. Quality as well as quantity must be considered.

Ground Water More Satisfactory

The quality of river water in Kansas varies greatly with the seasons. This is true in regard to both organic and inorganic matter. At times each year algae are extremely abundant in waters of Kansas rivers and other organic material is commonly present. It has been pointed out that waters rich in algae clog filters and producing formations, and build up deposits in pipes in a short time (WORLD OIL, 1947). During rainy seasons the amount of silt in river waters is enormous. For these reasons the treatment problem for river water is difficult and in general groundwater is more satisfactory. Groundwater usually remains uniform in chemical composition for long periods and therefore any treatment required before injection need not be changed.

Practically unlimited amounts of brine are available in oil-bearing and other deep formations in Kansas. Shallower and slightly mineralized or fresh water is not so plentiful especially in most of the eastern part of the state. However, in the extreme southeastern part of Kansas the deep Ordovician and Cambrian rocks bear fresh water and the shallower Mississippian water is more highly mineralized.

In some Kansas fields several millions of barrels of water are produced annually with the oil and at least one field yields more than one-half billion barrels of produced water each year.

Analyses of representative brines produced with oil from several formations and oil fields are shown in Table 1.

A posthumously published report by Dr. G. E. Abernathy (1948) is a valuable contribution to the knowledge of deep waters available for water-flood projects in southeastern Kansas. Table 2, showing chemical analyses of water from the Lamotte sandstone, Roubidoux formation, Cotter dolomite (Arbuckle), and from Mississippian rocks, is modified from tables in Abernathy's report.

ACKNOWLEDGMENTS

[1] Much of the factual data concerning water-flood projects used in this paper was obtained through the generosity of Albert E. Sweeney, Director, Secondary Recovery Division, Interstate Oil Compact Commission, Oklahoma City. Sweeney, aided by D. C. Lilley, Division of Conservation, Kansas State Corporation Commission, Wichita, recently made a survey of Kansas repressuring projects. Data regarding several projects not included in Sweeney and Lilley's investigation are from an earlier survey by Dr. G. E. Abernathy and the writer.

[2] Published with the permission of Dr. Raymond C. Moore, Director of Research, State Geological Survey of Kansas.

BIBLIOGRAPHY

Abernathy, G. E., **1948,** Ground Waters Available for Water-Flooding Oil Projects in Southeastern Kansas: Trans. Kansas Acad. Sci., vol. 51, no. 1, pp. 125-130.

Abernathy, G. E., and Jewett, J. M., **1946,** Water Flooding Oil Formation in Kansas: Mines Magazine, vol. 36, no. 11, pp. 527-528.

Bass, N. W., **1936,** Origin of the shoestring sands of Greenwood and Butler Counties, Kansas: Kansas Geol. Survey, Bull. 23, 135 pp., 10 figs. 21 pls.

Charles, Homer, **1927,** Oil and Gas Resources of Kansas, Anderson County: Kansas Geol. Survey, Bull. 6, pt. 7, 95 pp., 13 figs., 10 pls.

Clair, J. R., **1948,** Preliminary Notes on Lithologic Criteria for Indentification and Subdivision of the Mississippian Rocks in Western Kansas: Kansas Geol. Soc., Wichita, 14 pp.

De Lozier, Paul, **1947,** Water Treating for Secondary Recovery: Oil Weekly, vol. 125, no. 13, pp. 53, 57-58.

Fancher, G. H., and Barnes, K. B., **1936,** Water-Flooding in the Mid-Continent: Am. Institute Mining and Met. Engineers Trans., Petroleum Development and Technology, vol. 118, pp. 138-176, 2 figs.

Grandone, Peter, **1944,** History of Water-Flooding of Oil Sands in Kansas: U. S. Bur. Mines, Rept. Investi. 3761, 146 pp., 52 figs.

Jewett, J. M., **1945,** Stratigraphy of the Marmaton group, Pennsylvanian, in Kansas; Kansas Geol. Survey, Bull. 58, 148 pp., 4 pls.

Jewett, J. M., and Abernathy, G. E., **1945,** Oil and Gas in Eastern Kansas: Kansas Geol. Survey, Bull. 57, 244 pp., 21 figs., 4 pls.

Lee, Wallace, **1940,** Subsurface Mississippian Rocks of Kansas: Kansas Geol. Survey, Bull. 33, 114 pp., 4 figs., 10 pls.

Maher, J. C., and Collins, J. B., **1948,** Hugoton Embayment of Anadarko Basin in Southwestern Kansas, Southeastern Colorado, and Oklahoma Panhandle: Am. Assoc. Petroleum Geologists Bull., vol. 32, no. 5, pp. 813-819, 5 figs.

Moore, R. C., and Jewett, J. M., **1942,** Oil and Gas Fields in Kansas: The Mines Magazine, vol. 32, pp. 481-488, 515-520, 526, 560, 12 figs.

Moore, R. C., Frye, J. C., and Jewett, J. M., **1944,** Tabular Description of Outcropping Rocks in Kansas: Kansas Geol. Survey, Bull. 52, pt. 4, pp. 137-212, 9 figs.

Schoewe, W. H., **1943,** Kansas Oil Field Brines and their Magnesium Content: Kansas Geol. Survey, Bull. 47, pt. 2, pp. 37-76, 3 figs.

Sweeney, A. E., Jr., **1948,** The Magnitude of Water-Flooding Production in Kansas: Paper no. 851-22-J, Div. of Production, Am. Petroleum Institute, Dallas, Texas, 3 pp. 2 figs.

Terwilliger, P. L., and Yuster, S. T., **1947,** Chemical Agents in Water-Flooding: Oil Weekly, vol. 126, no. 1, pp. 54-56, 2 figs.

Wierich, T. E., **1937,** Petroleum Geology of Washington and Nowata Counties, Oklahoma: Kansas Geol. Soc. Guidebook, 11th Ann. Field Conf., pp. 85-92.

World Oil, **1947,** Slime and Algae Control in Oil Field Flood-Water: vol. 126, no. 9, July 28, 1947, p. 88.

Deep Oil Well Pumping

■ CONTINUED FROM PAGE 140

stresses above 30,000 psi will be encountered.

As most sucker rod failures are the result of fatigue, the maximum working stress in a non-corrosive fluid is dependent on the life expectancy. If the true stress level at all points in the rods is below the endurance limit of the rod material in the condition existing in the rod, its life will be infinite. If the stress magnitude is above the endurance limit, the rod will fail after some definite number of stress applications. As the published values of endurance limit are based on machined specimens free of stress raisers, the endurance limit of the material when fabricated into a sucker rod will be less than this ideal value. However, it will be proportional to this value and the laboratory endurance limit value can be used as a basis of comparison as well as application. As the service life of a sucker rod operating at a stress level in excess of the endurance limit is a function of the number of stress applications, the maximum number of barrels of fluid per pound of sucker rod used will be attained when pumping with a long pumping stroke and a low number of strokes per minute. As the usual published endurance limit values are based on completely reversed bending, they do not give a complete picture of the effect of the pumping load on sucker rod life, because the range of stress influences the true endurance limit. J. O. Almen[6] explained that the endurance limit is a function of the range of stress, and the value of the endurance limit increases as the stress range approaches zero. This is illustrated by the graph shown in Figure 7 which was taken from his paper. This indicates that the sucker rod life can be increased if the pumping motion is selected to give a minimum range of stress. This condition should be attained with slow rates of pumping speed which are not synchronous with the natural frequency of the rod string. These slow rates of pumping speed will give low rates of acceleration which will help maintain a minimum range of sucker rod load.

REFERENCES

[1] Effect of Design and Direction of Rotation on Peak Torque of Pumping Units, by Kenneth N. Mills and E. A. Olsovsky, The Petroleum Engineer, August, 1939.

[2] Factors Influencing Well Loads Combined in a New Formula, by Kenneth N. Mills, The Petroleum Engineer, April, 1939.

[3] Well Load Formulas, API Production Bulletin 230, 1943, page 442.

[4] Vibration Problems in Oil Wells, by J. C. Slonneger, API Drilling & Production Practice, 1937.

[5] Problems in Modern Deep Well Pumping, by C. J. Coberly, Spring Meeting of The American Society of Mechanical Engineers, Los Angeles, California, 1938.

[6] Fatigue of Metals as Influenced by Design and Internal Stresses, by J. O. Almen, Presented at Twenty-Seventh National Metals Congress and Exposition, Cleveland, Ohio, February, 1946.

Serving the industry with a 100 MILLION DOLLAR INVENTORY

The Supply Industry . . . with an outlay of more than 100 MILLION DOLLARS in inventory for you . . . truly has earned a place in the progress of the petroleum industry.

This 100 MILLION DOLLAR inventory is located . . . not in industrial centers where the equipment is made . . . but in 700 different points *in the oil country.*

This 100 MILLION DOLLAR inventory is available to you 24 hours a day, 365 days each year.

This 100 MILLION DOLLAR inventory is only one service rendered by your supply store.

PATRONIZE YOUR SUPPLY STORE AND YOU:

1—Have access to tremendous stocks.
2—Eliminate warehousing expense.
3—Eliminate losses from obsolescence.
4—Have a ready source of information.
5—Reduce your purchasing expense.
6—Reduce your transportation cost.

LARKIN

...Through Your Supply Store

LARKIN PACKER CO., INC. ST. LOUIS, MO.

Larkin Swage Nipples and Bull Plugs resist rust and corrosion both inside and out. Exhaustive tests in a live steam bath have proved that the new ZINCOTING is still unharmed after conventional finishes have rusted and discolored. Zincoting was developed by Larkin as another step in furnishing the finest fittings that can be made. They're on your supply store shelves now. Compare them.

Proper Servicing

LENGTHENS LEASE LIFE

By JAMES E. HANEY
Superintendent
Russell Oil Well Servicing
Company

The telescoping pole, rigged and ready for rod job.

NEW TECHNIQUES have been developed in well servicing and are being successfully applied in the oil fields. The operator who fails to take advantage of the new methods is shortening the life of his lease and his wells are headed for the economic junk pile.

As THE wells on a lease are completed and hooked up to the pumping power and the standard rigs are dismantled, the operator is confronted with the question of proper equipment for pulling rods and tubing and for other services which will be called for during the life of the well. Inadequate preparation or the employment of misfit equipment for a special job usually results in considerable grief which in turn is reflected in loss of production.

The past quarter-century has witnessed the passing of the old bull ropes and steam engines with the homemade "boll weevils" for lubricating purposes, the open rod hooks, the old "thumb buster" elevators, the rod troughs with the front end nailed to the headache post, and the horse-drawn portable "A" masts, just to mention a few types of equipment which featured well servicing activities in the early '20's.

Perhaps the most significant improvement in oil well servicing was the development of the regular truck-mounted pulling or servicing unit specially designed for the work and incorporating safety factors in brakes and motor power designed by engineers to fit almost every conceivable problem of the local operator. Another step toward economy and efficiency was the development of portable, telescoping masts which eliminated the necessity of the derrick. Some companies maintained a standard rig at about one well in five and pulled rods "across country" by having blocks anchored in the derrick floors through which lines operated from the crown blocks in the derricks. Such a method was found very unsatisfactory as the man operating the old steam engine was too far from the well where operations were in progress and accidents often resulted.

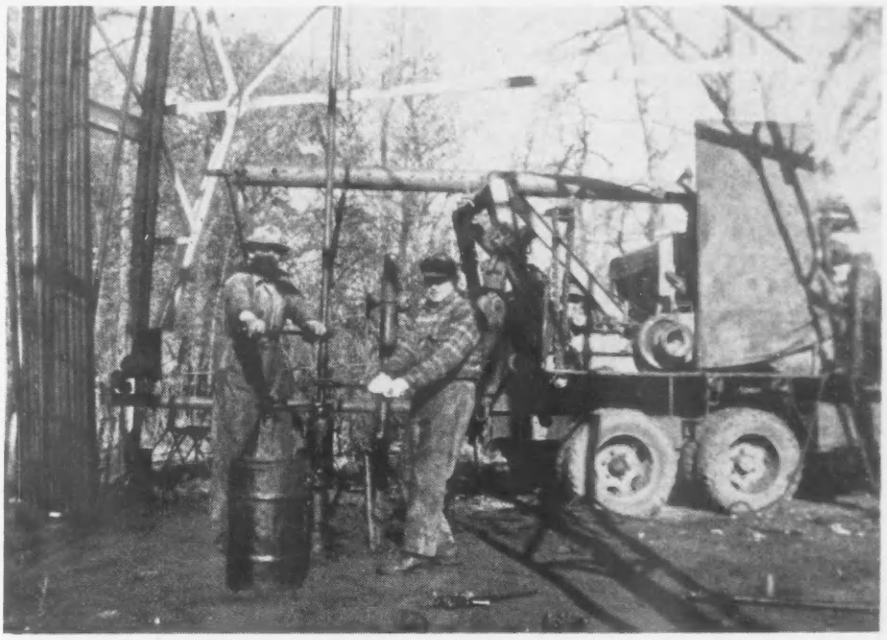
While cleanout jobs are numerous in practically all oil fields, perhaps the most common well servicing operation involves the fishing or pulling of rods and tubing and tools. The old "mouse trap" is still in use for fishing rods but today the overshot type combination rod sockets with slip catch every size of rod and "box" slips catch the broken boxes of the new style rods.

The efficient operator should keep abreast of new equipment trends, and catalogs and other equipment literature should be kept handy in the office or "dog house." Rod design has undergone a radical change during the past ten years and the operator who lacks the proper equipment to handle the new style rods, at best, can do a very poor job, which in the long run will cost much more than in warranted under the circumstances. Rods now in use are a far cry from the old box and pin rods.

Each type rod has been engineered to the requirements dictated by the type of oil being pumped, the amount of water to be handled, etc. Well conditions are checked periodically and critically observed by engineers. The efficient well servicing company or operator should do no less if he is to do a good job and assure an extended life to the lease.

Cups, or common valves, are still being used in pumping operations, although the cups and balls and seats have been greatly improved. A function of the efficient well servicer is to check well conditions and install balls and seats best suited to the individual well.

Manufacturers have developed pumps of all types for use in wells at all depths. The liner type pump, the plain plunger pump, the grooved plunger pump, the tubing-type pump, the bottom seating pump, the top seating pump, the inverted-type pump with pull tube, the regular-type pump with pull rod—all are in use today and the well servicing man should be familiar with their construction and operating features. Many pumps are designed for special duty subject to particular conditions. When pump trouble develops on the lease the pump should not be serviced on the lease but should be sent to the pump shop, one or several of which may be found in any field, where trained men can detect flaws and rebuild the mechanism to as near mechanical perfection as is possible under the circumstances.



The stinger rigged under a derrick, showing the position of the pole when not in use.

Detecting Tubing Leaks

Detection of tubing leaks is an important function of the well servicing company or the superintendent in charge of production. Formerly, tubing was pulled in order to determine the point of leakage. This was done until fluid was reached when a hard wood plug was set in the top of the tubing and hit with a sledge, thus opening the hole so that it could be detected. While this method worked fairly well, hydraulic hand pumps now can be used to apply pressure to open up holes and splits.

In well servicing operations in Kansas the writer has applied a technique for finding leaks involving the use of paint and kerosine which has given good results. In operation the string is "pulled dry" by first pulling the standing valve, or if a pump is in the hole, by not dropping in a "drop" valve. Aluminum paint, preferably ready mixed, and kerosine are then blended in the ratio of one quart of paint to 15 gallons of kerosine. Fifteen gallons of the mixture is sufficient for use in three-inch tubing and proportionately less for smaller tubing. The mixture is poured into the tubing as it is pulled, a sufficient amount being injected to keep the inside of the tubing completely covered. Care should be used in pouring so that none of the mixture is spilled on the outside of the tubing and to see that the inside of the tubing is completely covered and additional mixture added whenever the inside of the tubing begins to streak. A leak will show up by the mixture seeping through from the inside and showing on the outside of the tubing. This simple technique has been used on many jobs with only three failures reported—one due to a loose coupling and two on badly paraffined wells. The method, incidentally, is not recommended where bad paraffin conditions are present.

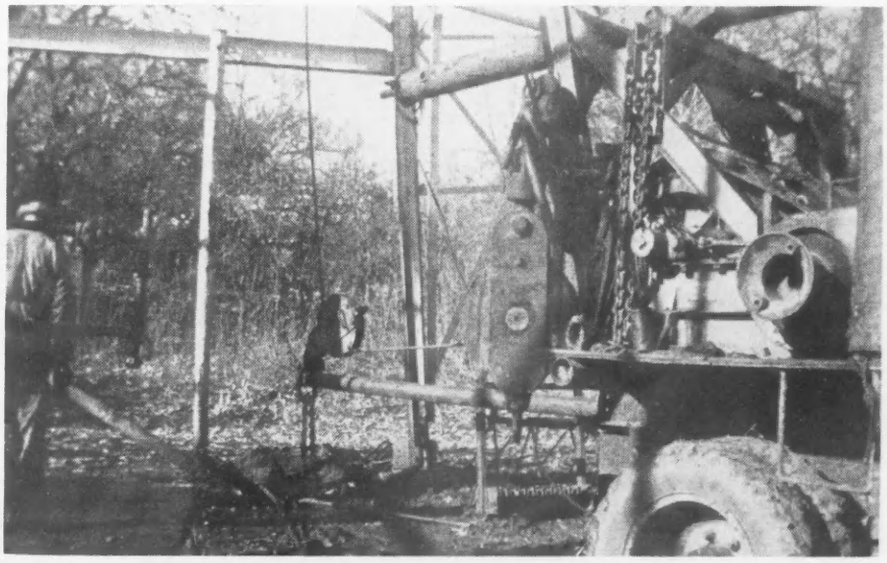


Photo showing the advantage of the stinger in rigging up in a difficult location. This well was located in a small creek with a high bank on one side and a deep washed ditch on the other.

Rigging Up Units

The ebb and flow of activities in various oil fields frequently result in heavy turnover among well servicing crews. Although there are many experienced men in the industry who have devoted their lives to this phase of operations, there are also many new men who have

little or no knowledge of the tools and techniques with which they are working. To the new men perhaps a few words on how well servicing units are rigged up and the care which must be exercised in pulling wells may be of practical value.

Telescoping Mast

The regular telescoping mast used by most well servicing companies is from 48 feet to 50 feet in height and is capable of pulling tubing in lengths up to 32 feet. The mast is rigged with four guy wires for regular pulling. Additional guy wires may be added at the center of the pole to take care of excessive loads. Stakes approximately five feet in length are driven into the ground, two in front and two in back of the machine, so that they pull against each other and act as stabilizers for the pole over the center of the hole. Where turnbuckles were previously used, the faster "come-along" boomer has replaced them. This boomer has a five-foot chain that can be taken in or let out much faster than the turnbuckle.

Some poles have been lengthened so that rods of conventional size can be pulled in doubles, although some well servicing companies frown on the practice and contend that the use of the longer poles result in the bending of rods when laid down and picked up. Some well servicing companies are experimenting with poles in which the rods can be hung in doubles and doubtless this technique eventually will be worked out and the poles perfected and put into universal use. Current practice calls for the use of metal "rod horses" similar to the common wood carpenter saw horse. At the end and just below the top of the frame of the horse, a piece of sucker rod is welded horizontally. On this attachment is placed a trough made by ripping a piece of three- or four-inch pipe. For best results two pieces of pipe about a foot long are used so that the trough can be more easily handled, allowing the trough to lap in the middle. When the trough is in place one man can easily slide the rods into the trough as they run into the hole. The rods will go in smoothly and the rod weight hang straight without excess swinging, making the job of stabbing the rods less difficult. A piece of one- or 1¼-inch pipe welded onto the bottom of the rod trough at right angles will slip over the sucker rod welded on the rod horse and hold it in place.

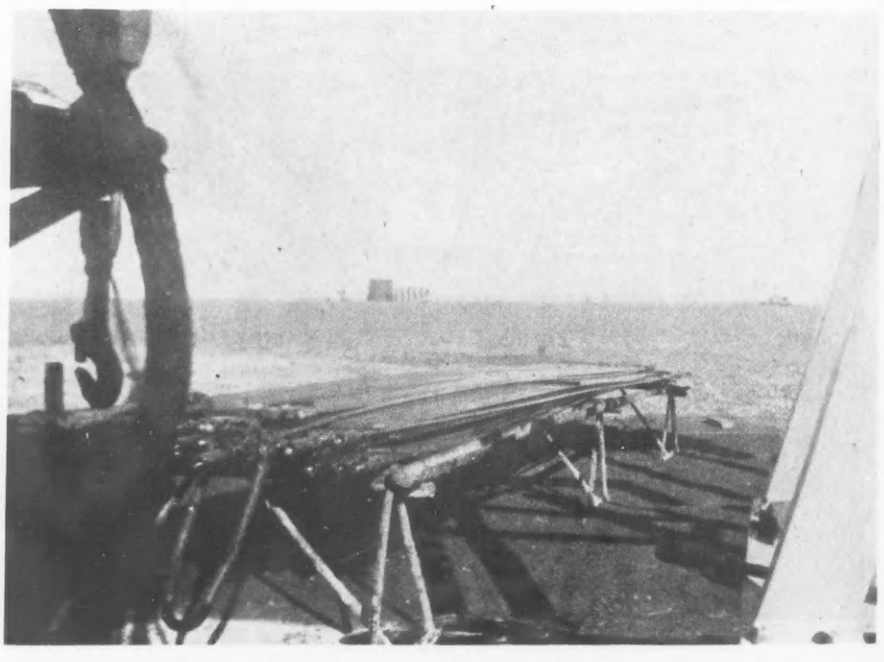
Use of Stinger

Another device used to speed up rig time is the "stinger." This is fabricated from a piece of four-inch drill pipe and a piece of five-inch line pipe, the smaller piece designed to telescope into the pipe of larger diameter. The five-inch pipe is cut to fit the length of the truck and extends from the cab to the rear of the unit. The pipe is welded or fastened by "U" bolts to the cross members of the truck bed and the frame of the unit. The four-inch drill pipe is cut about six inches longer than the five-inch section so as to allow room to weld an eye on the bottom and an adapter for the floor block on the top.

The "stinger" should be spaced in the center of the working section of the unit drum, i.e., the portion of the shaft used in pulling rods and tubing, but not including the reserve section. A hole should be cut through the five-inch pipe so that a pin about 1½-inch in diameter can be dropped through. At the same time the four-inch pipe should extend behind the truck and in line with the five-inch pipe so that a hole can be cut in the four-inch to correspond with the hole in the five-inch. The "stinger" is usually about 12 feet in length, allows the servicing unit truck to remain clear of the derrick floor. It enables the truck to avoid soft spots around the rig and can be rigged up for any angle. By extending the "stinger" and using a "C" link or extra heavy duty chain, the floor block can be put into place in a few seconds.

Other Recommendations

Other recommended improvements which contribute to efficiency and economy in well servicing work include the rod weight with swivels on both ends to absorb the line spin and help pull the line down as the rods are pulled and hung in the derrick; the quick change bucket which is a big improvement over the old style use of wire line clamps and permits the changing of the rod line from one tool to another is a matter of seconds; the jar-wrenches, the paraffin strippers for rods, as well as other improvements and techniques which a competent well servicing man can apply in his work and which, in the long run, contribute to the life of the lease.



The rod trough in place on the rod horse. Ready to run rods into the well.

About the Author

JAMES E. HANEY first "tailed" rods during his high school vacations in the Burkburnett field where he was raised. After leaving school he went to work for the Gulf Oil Company in the trouble-shooting gang. After working for various companies he went with the Champlin Refining Company and in 1943 resigned as district superintendent to enter the well servicing contracting business.

Fully Automatic ELECTRIC-POWERED Gathering Station

By F. H. WARREN

General Superintendent, Eastern Division, Pipe Line Department
The Ohio Oil Company

IN THE fall of 1945 the Pipe Line Department of our company was confronted with a problem of designing a gathering system to serve an oil field, the production of which was increasing rapidly due to water flooding. Specifically, it was the old Siggins Pool in Clark and Cumberland counties of southern Illinois.

Originally a gathering system was constructed and a discharge line laid to a tank farm just north of the town of Casey, Ill. Until the main trunk line of The Ohio Oil Company was completed east of Martinsville in late 1906, the crude was shipped in tank cars to the Standard Oil Company refinery at Whiting, Ind. Our company constructed a pipe line to our Martinsville, Ill., tank farm in 1906 and operated it until early in 1941, when it was taken out of service because of bad pipe and greatly reduced volume. By that time the production had dwindled to less than 100 barrels per day, and a local contractor was engaged to truck the oil to Martinsville.

Early in 1943 a water-flooding project was started. By midsummer, 1945, crude production was approaching 600 barrels per day and it became evident that the old gathering system would have to be reconditioned and put back into service.

A survey revealed that the original field station was improperly located and a new station site was selected. The old gravity system was revamped and is shown on the attached map. One line of the main trunk lines between Wood River and Martinsville carries Illinois Basin crude and passes within approximately three miles of the new station location. It was therefore decided that the oil should be injected into the Illinois Basin stream at that point. The operator of the water-flood project was in the process of electrifying the operation. The power company at the time was building a transmission line into the area with ample capacity to serve us. We therefore decided to construct an electric pump station, and furthermore to make it completely automatic.

The schematic arrangement of equipment used in the original automatic field station is shown in Figure 1. A photograph of an installation is shown in Figure 2. An air separator was installed in the gravity line from the field in order to take care of those cases when air is accidentally drawn into the lines. The separator tank is five feet in diameter and seven feet high, having a partition plate extending approximately 4½ feet up from the bottom, dividing the separator into two oil tight compartments. A small blower driven by a three-horsepower motor was connected to the top of the air separator to pull out any air that might accumulate. A rotary transfer pump of approximately 200 barrels per hour capacity driven by a five-horsepower motor was installed to pump the oil from the air separator to a 5000-barrel storage tank. A 4x6-inch pump driven by a 20-horsepower motor became the discharge pump.

On the more recent installations, a sump has been added with a small capacity, float, controlled sump pump. In case of excessive leakage, such as a blown gasket, the sump will fill up and cause a second float to shut down the entire station. All motor controls and electrical equipment are of the open type and are installed in a vapor-tight room.

Since Casey station was to inject oil into the main trunk line it would be necessary for the dispatcher to know the quantity of oil delivered into the system

A FIELD gathering station which is fully automatic, and which through a positive-displacement pump serves to meter input to the connecting trunk line, provides delivery of production from a field without necessity for immediate supervision. This installation, described by the author in a paper before the Petroleum Division, American Society of Mechanical Engineers, at the Petroleum Mechanical Engineering Conference held in Amarillo, Texas, October 3-6, 1948, successfully handled a throughput of 2000 barrels of crude per day, with availability of approximately 100 percent.

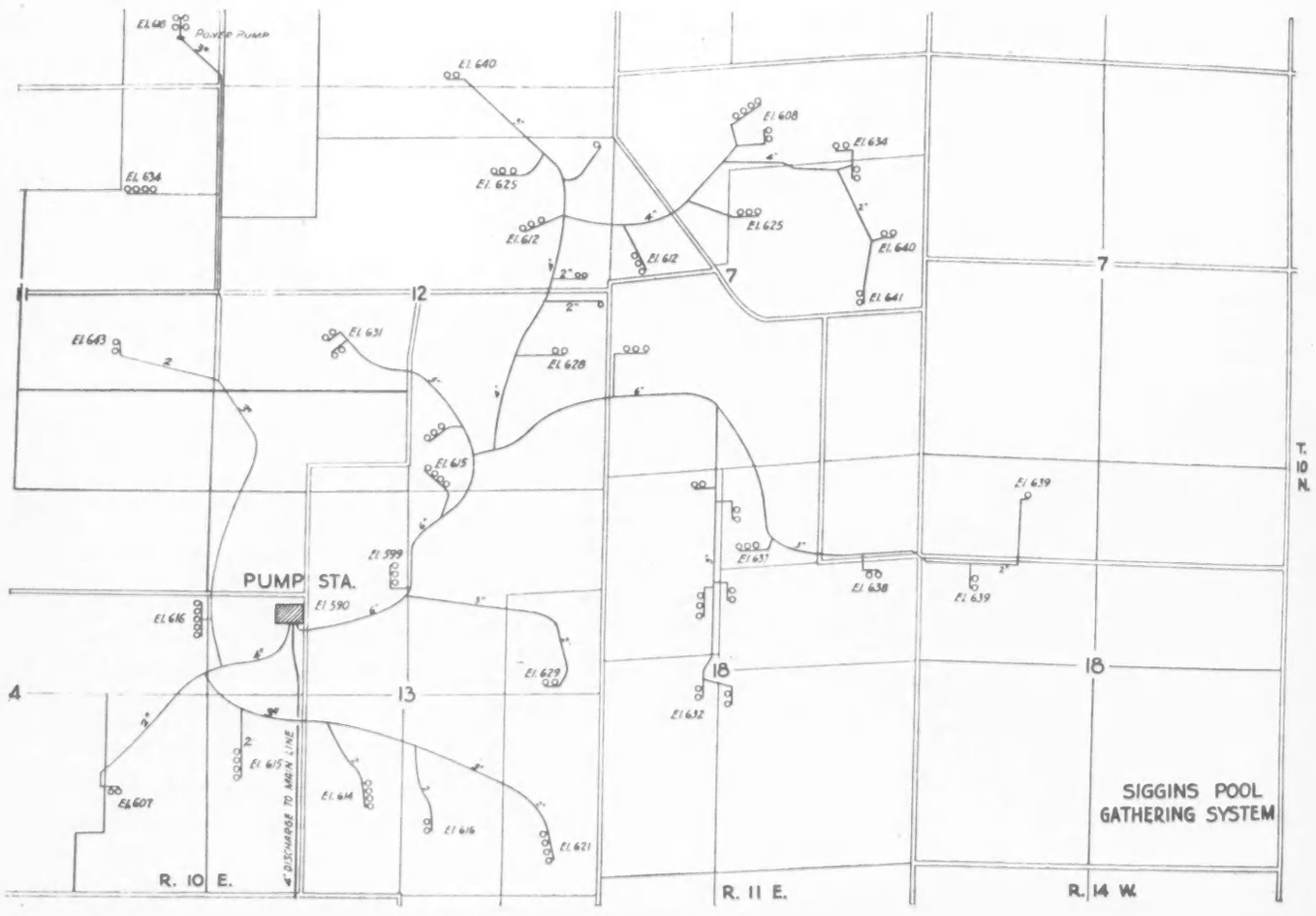
each hour. It was decided that for line dispatching purposes the output of a constant speed piston pump would be sufficiently uniform to indicate the quantity of oil pumped if some reliable means of recording the amount of time the unit operated could be devised. In order to record the operating time a remote reading pressure gauge was installed with the receiving instrument in the gauger's office at Martinsville, about seven miles distant. The electric circuit for transmitting the pressure impulses was superimposed on the company-owned telephone line that parallels the pipe line at this point. The receiving instrument at Martinsville records the pressure on a continuous chart. The Martinsville gauger has merely to note the amount of time Casey operated the previous hour, convert it to barrels pumped, and report it to the dispatcher hourly when he turns in his own check.

The principal difference between the automatic field station described and the ordinary field installation lies in the air separator tank. A vacuum of approximately eight inches of mercury is maintained in the top of the air separator tank at all times, unless the tank is filled with oil to a level where the switch actuated by float B has shut down the vacuum pump. The vacuum pump is controlled by vacuum switch A, and a mercoid tube switch actuated by float B connected in series with the motor starter control circuit. The vacuum in the air separator must be below the value at which Switch A closes, and float B must be in its lower position before the vacuum pump motor will start. The vacuum pump motor will shut down, however, when either the vacuum or the liquid level has been established.

In operation, the field gauger turns on lease tanks in the usual manner, and there being a vacuum in the air separator, oil from the field flows into the separator, over the partition plate, and fills compartment No. 2 containing two floats, B and C, which actuate switches having multiple mercoid tubes. When compartment No. 2 has filled to approximately the height of the partition plate, float B starts the transfer pump. If the vacuum pump was running at this time float B also simultaneously shuts down the vacuum pump.

Unless air has entered the gravity lines, the liquid level in the air separator will generally continue to rise, and in the case of lease tanks elevated considerably above the station, the oil will completely fill the separator tank. In order to prevent oil going over through the vacuum pump, a normally closed solenoid operated valve is installed in the vacuum line. The solenoid of this valve is connected in parallel with the vacuum pump motor and remains open only while the vacuum pump is operating. The transfer pump continues to operate until the oil in compartment 2 drops below the center line of float C, which breaks the holding coil circuit of the transfer pump motor starter and shuts down the transfer pump. Float C will not start the transfer pump; it merely maintains the holding coil circuit after switch actuated by float B has completed the circuit. A check valve is installed on the discharge side of the transfer pump.

After the oil level has reached a predetermined height in the 5000-barrel storage tank, float switch E causes the discharge pump to start. A normally open solenoid bypass valve D is installed between the discharge pump and a check valve. This solenoid bypass valve is connected in parallel with the discharge pump and performs two functions. It opens the instant the discharge pump shuts down, allowing the pressure in the pump to drop quickly and thus informs the gauger at Martinsville that Casey station has gone down. When the discharge pump starts up, valve D remains open until the motor has attained



full speed. This is accomplished by means of a time delay relay. The discharge pump is driven by a normal torque, normal starting current squirrel cage motor. The unit comes on the line without difficulty against pressures in excess of 500 pounds.

The automatic stations are under the direct care of the field gauger in charge of the district. He gauges the storage tank every weekday at 7 a.m. and telephones the gauge into the office. He changes a recording pressure gauge chart, inspects the equipment and keeps the station presentable. Our electrical department checks the equipment about every two months to make any necessary adjustments. The availability has been practically 100 percent.

The first automatic electric field station went into operation in December, 1945. Production handled by this station has increased from approximately 600 barrels to more than 2000 barrels per day. The original 20-horsepower motor has been replaced by a 30-horsepower motor and the pump speeded up from about 70 barrels per hour to approximately 140 barrels per hour. A ten-inch stroke pump is on order to replace the original pump. An additional transfer pump to be started and stopped from float B soon will be installed to take care of peak loads, but no other changes are indicated. We now have six completely automatic stations in operation and two semi-automatic installations, using only a portion of the original set-up.

When the Engineering department first proposed this system, there was considerable doubt in our minds as to the advisability of maintaining a vacuum in the air separator. In actual practice, however, we find the vacuum pump operates only a few seconds when oil is first turned on and will seldom average more than 10 or 15 minutes operation per day. Automatic shutoff valves were installed at approximately one-third of the tank batteries and have proved to be quite an effective means of keeping air out of gravity lines. We feel some automatic shutoff valves are required for best results with this type of installation.

The automatic electric stations have been much more economical than the older type of station, utilizing engine-driven pumps. In most cases the power cost has been less than the cost of fuel, lubrication and repairs of engine-driven pumps. There has been a slight reduction in manpower. The district gauger's job has been made easier because oil comes out of the lease tanks much faster. Evaporation loss has been reduced considerably. The first cost of the stations is quite reasonable and maintenance expense has been very low.

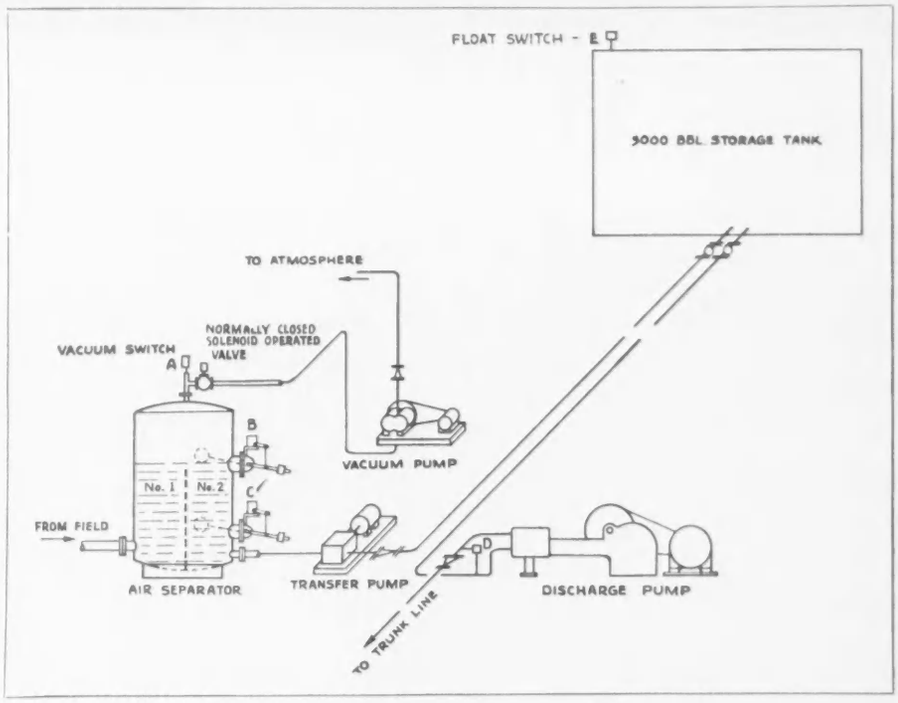


FIGURE 1

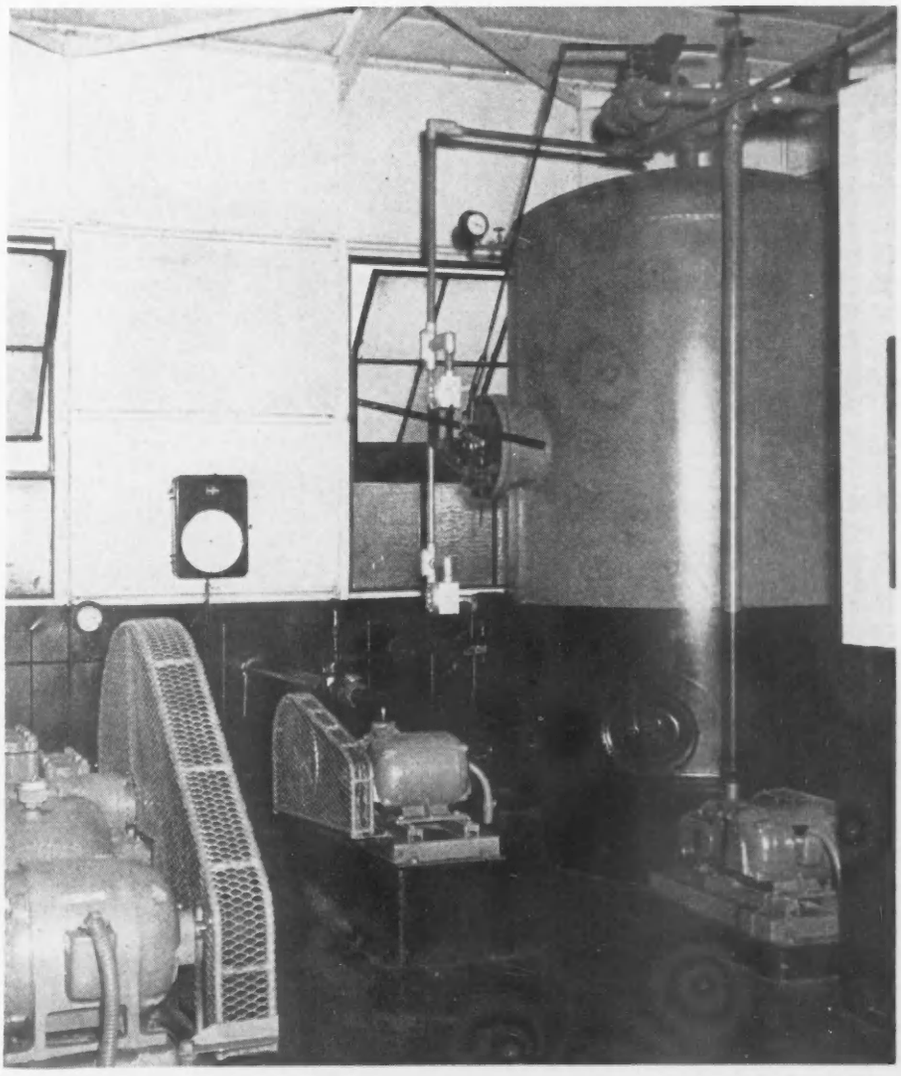


FIGURE 2. This installation, differing from the one described only in that a lever-operated, double-seated valve is used in the vacuum line instead of the solenoid-operated valve mentioned in the article, is shown as a typical setup, and is presented because it, alone of the installations, is in a room large enough to permit a photograph to be obtained.

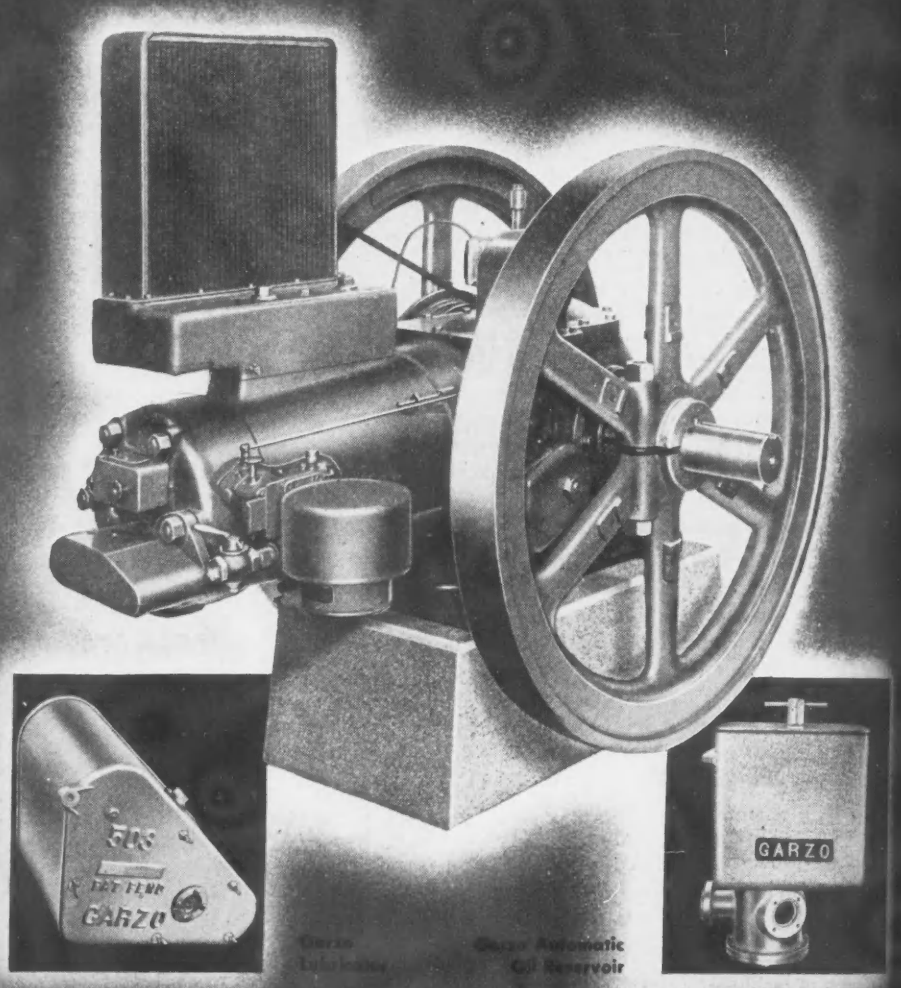
For Better Pumping at

Fairbanks-Morse ZC Engine

Equipped with Garzo Lubricators and Garzo Automatic Oil Reservoir

Brings You These Leading Production Equipment Lines

- American Manufacturing Company
- Bradford Motor Works
- Buda Company, (The)
- Cameron Iron Works
- Chaplin Fulton Manufacturing Co.
- Fairbanks-Morse & Company
- Garzo Products Company
- Gates Rubber Company
- B. F. Goodrich Company
- Goodyear Tire & Rubber Company
- Harbison Fischer Manufacturing Company
- Hercules Motor Company
- Chas. N. Hough Manufacturing Co.
- J. M. Huber Corporation
- Hughes Tool Company
- International Derrick & Equipment Co.
- S. M. Jones Company
- McEvoy Company
- Maloney-Crawford Tank Company
- Miller Sand Pump Company
- W. C. Norris Manufacturer
- Walter O Bannon Company
- Oil Center Tool Company
- Pacific Pumps, Inc.
- Rector Well Equipment
- Reda Pump Company
- Sterling Packing & Gasket Co.
- Stockham Pipe Fittings Co.
- Tretolite Company
- United States Rubber Company
- Victaulic Company, of America
- W-K-M Company
- Waukesha Sales & Service, Inc.



Garzo Lubricator

Garzo Automatic Oil Reservoir

Check these outstanding features which make ZC slow-speed, horizontal heavy-duty engines the best buy in the field . . . Vapor cooling . . . roller bearings . . . extra heavy flywheels . ..self-oiling . . . fully enclosed . . . gas-gasoline carburetors . . . greaseless clutches with built-in shifter.

Equipped with Garzo Lubricators you get easier starting . . . cooler valve mechanism . . . better performance.

The Garzo Automatic Oil Reservoir eliminates shutdowns for replenishing oil . . . provides increased oil storage for longer operation without attention . . . makes easier, safer gauge readings.

Experienced operators have learned to appreciate these extraordinary features for pumping engine service . . . they have found that ZC will do a better job at less cost than other prime movers.

Less Cost Republic Offers

Heavy demand for crude oil and current high prices emphasize the need for modern and efficient production equipment to assure maximum output and increased profits.

REPUBLIC has the answer with its carefully selected and coordinated line of production equipment which meets every requirement from a single marginal producer to the most prolific producing lease.

For maximum efficiency at low cost call

REPUBLIC

"Your Supply Store"

Fairbanks-Morce ZC Pumping Engines are only one of the many lines of distinguished products associated with Republic Supply Service.

SERVES YOU FROM THESE POINTS

ARKANSAS
El Dorado, Patmos

•

COLORADO
Denver

•

ILLINOIS
Chicago, Grayville
McLeansboro, Salem

•

KANSAS
Ellinwood, Russell, Wichita

•

LOUISIANA
Haynesville, Lake Charles,
Mamou, New Iberia,
Rodessa, Shreveport

•

MISSISSIPPI
Hattiesburg, Jackson

•

NEW MEXICO
Artesia, Eunice, Hobbs

•

OKLAHOMA
Bartlesville
Cement, Elmore City,
Oklahoma City,
Seminole, Tulsa

•

TEXAS
Abilene, Alice, Big Spring,
Borger, Columbus,
Corpus Christi, Dallas, Electra,
Falfurrias, Fort Worth, Freer,
Hebbronville, Houston, Kamay,
Kenedy, Kilgore, Nocona,
McAllen, Odessa, Olney,
Pampa, Pleasanton,
San Antonio, Sundown, Talco,
Victoria, Wichita Falls.

•

WYOMING
Casper

•

General Offices
Houston, Texas

Republic Supply COMPANY
GENERAL OFFICES • • • HOUSTON 1, TEXAS

YOUR SUPPLY STORE

Insuring V-Belt Life

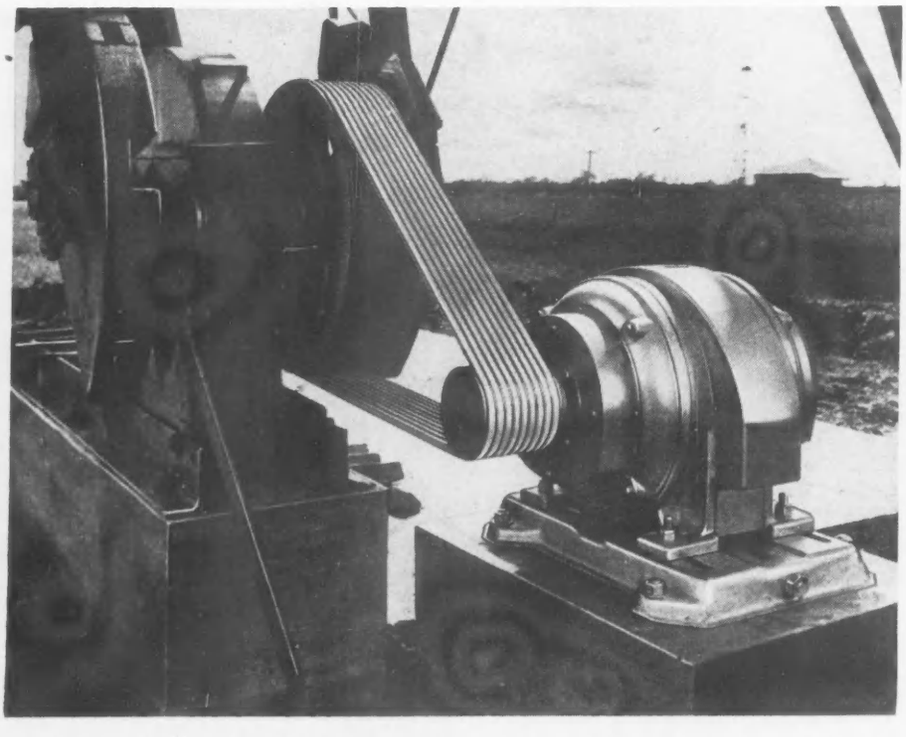
By E. A. GAHL
Application Engineer
Allis-Chalmers Manufacturing Company

MANY V-belt users, suspicious of any change in materials "forced" by wartime shortages, look upon today's V-belts as inferior "wartime" belts, and blame "substitute" materials for any belt troubles they may be having.

Actually, today's V-belts are the best belts ever made. The use of Buna-S has materially improved the service of V-belts over those made of natural rubber. New types of cotton are available, and new methods of cord treatment. Other synthetic rubbers, such as Neoprene, and such cord materials as nylon, rayon, and steel cables, are available for special-purpose belts. There can be no doubt that belts available now are far better than prewar belts.

Yet some operators actually are not getting the service they can and should get from these better belts, and a few are even having new belts wear out faster than the old belts which they have replaced. The point to be emphasized is that these troubles are not the fault of the belts, but result from the operator's lack of understanding or attention to proper care, especially during installation and the breaking-in period.

V-belts being replaced now were probably installed when such drives were comparatively new and untried. It was natural then to study the manufacturer's instructions carefully, to understand the principle of the V-belt drive thoroughly, and to install it and break it in cautiously and correctly. But as the drives operate for months and years without much attention, it is just as natural to lose track of the fact that they ever required any careful attention. So when a belt finally does break and a new set of belts is installed, it is difficult to remember that a V-belt drive requires the same careful installation and operation as any other piece of precision-engineered equipment.



The slotted motor base allows the driving unit to be shifted to bring the exact amount of tension into the belt. When measuring center distances where the two shafts are not at the same level, the angle between the two must be observed when checking to obtain desired adjustment.

When a new set of belts is installed on a drive, the most important thing to remember is that proper belt tension must be obtained and maintained. The belt that grips the sheave grooves without slipping runs evenly, since it does not have worn spots from slippage. All of the power which the belt transmits has to pass to and from the belt through the tough, strong cover. If there is slip, the cover wears and deteriorates rapidly. Furthermore, when a belt is slipping, the slippage must be overcome first, before the belt will transmit power. The properly tensioned belt runs without slippage and so can transmit its full power capacity without undue wear.

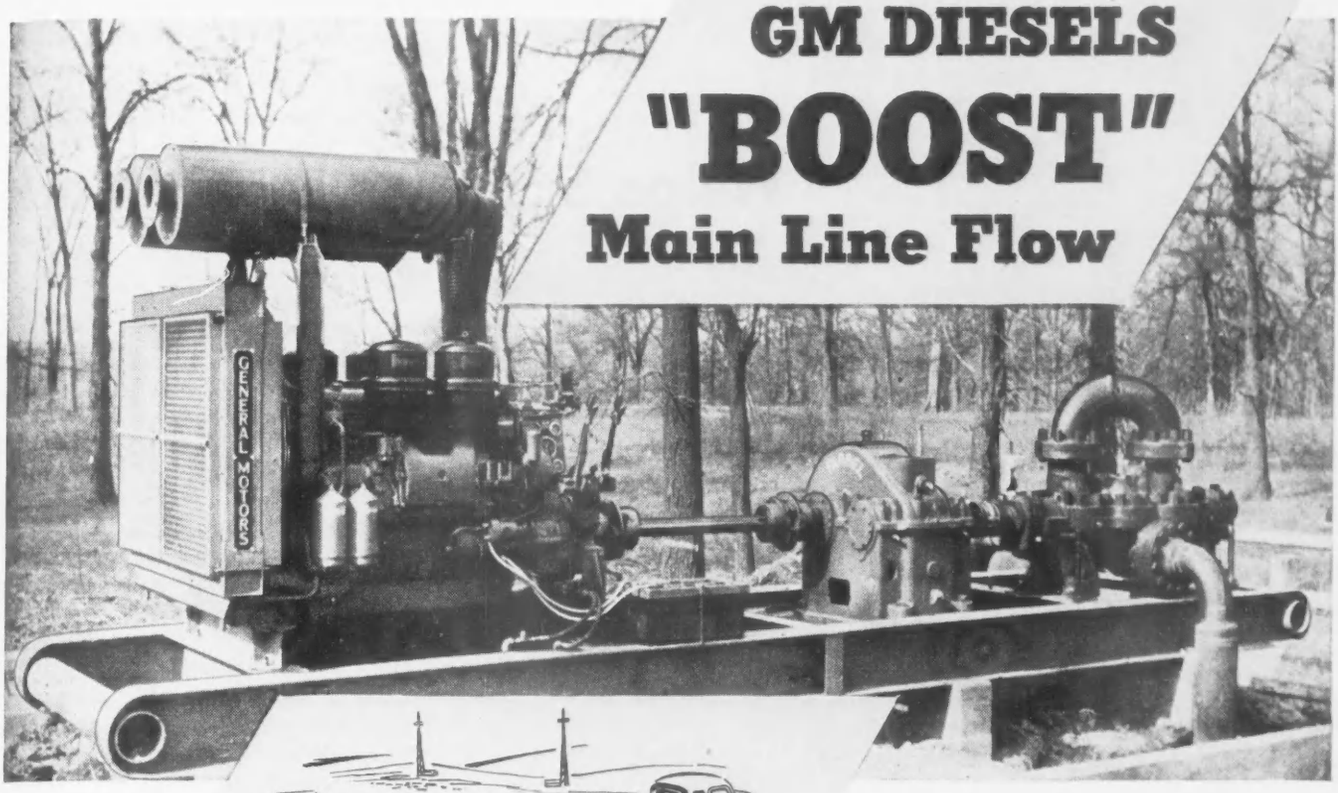
After the sag is eliminated, the distance between sheave centers should be increased by an amount which will increase the belt length by approximately ½ of 1 percent. This increase is usually accomplished by moving the motor on its sliding base (see Figure 1). A good rule to follow—one which is accurate enough for all practical purposes, and which will never get the operator into trouble with belt slip or with his machine bearings—is, for each 100 inches of center distance (after sag has been removed) take up another one-half inch. Thus where center distance is 50 inches, it will be increased ¼ inch to make it 50¼ inches. Where it is 300 inches, it will become 301½ inches. This will put ½ of 1 percent stretch on the belts.

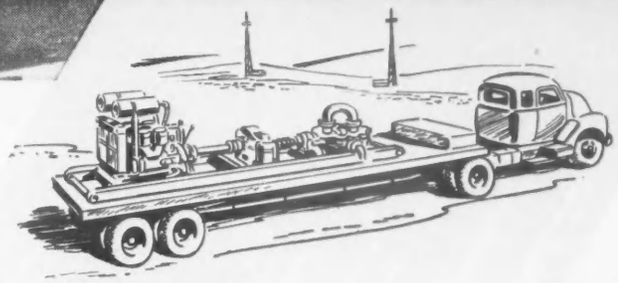
Now that the belts are properly tensioned, the operator should thump the belt with his hand, and note the live springiness of the belts. He should watch the belts carefully during the breaking-in period of a few months, taking up occasionally to maintain this original tension. He will be repaid by getting maximum service.

The problem of sag when a set of belts is first installed is confusing to some operators, who find that some belts appear much longer than others. Naturally it would not be desirable to have some belts in a drive longer than others; this is why manufacturers are prepared to furnish sets of matched belts for multiple-

■ CONTINUED ON PAGE 169

GM DIESELS "BOOST" Main Line Flow





Portable pumping unit designed around a General Motors Series 71 "Twin" by the Diesel Power Company of Oklahoma City for Phillips Petroleum Company

TO step up the flow of petroleum products in its 8-inch main line between St. Louis and Chicago, Phillips Petroleum Company has installed three of these completely portable pumping units.

A General Motors Series 71 Diesel "Twin 6," delivering 260 rugged continuous horsepower, drives a 4-stage centrifugal pump at 3600 r.p.m. through a speed increaser. Throughput is 32,000 barrels per day at 365 p.s.i. differential pressure.

GM Diesels were chosen for this work because their compact 2-cycle design—power at every downstroke—makes them quick starting, smooth and dependable in operation and unusually powerful for their modest size and weight.

In fact, the entire pumping unit weighs less than 14,000 pounds—can be easily picked up and moved by truck for emergency installation anywhere on the line. No elaborate foundation is necessary.

For complete details of this sturdy, money-making, easy-to-maintain power, consult your GM Diesel distributor listed below or drop us a line.

DETROIT DIESEL ENGINE DIVISION

SINGLE ENGINES.. Up to 200 H.P. DETROIT 28, MICHIGAN MULTIPLE UNITS Up to 800 H.P.

GENERAL MOTORS

DIESEL BRAWN WITHOUT THE BULK

GM GENERAL MOTORS DIESEL POWER

GENERAL MOTORS CORP., DIESEL ENGINE SALES, PETROLEUM INDUSTRY, 1504 Philtower Bldg., TULSA 3, OKLAHOMA

Anderson-O'Brien Co. LOS ANGELES 21, CALIFORNIA
George Engine Co. NEW ORLEANS 18, LA.
Western Machinery & Engine Co. ST. LOUIS 10, MISSOURI
Diesel Power Co. OKLAHOMA CITY, OKLAHOMA
Empire Oil Field Machinery Co. ODESSA, TEXAS
Power Equipment Inc. WICHITA, KANSAS
United Tool & Valve Repair Co. SHREVEPORT, LOUISIANA
Seitz Machinery Company Inc. BILLINGS, MONTANA
Stewart & Stevenson Services Inc. HOUSTON 11, TEXAS
Gehring Equipment Co. CASPER, WYOMING

Tubing Cutter

Helps Stripper Field Work

By HARRY GRAVES,
McGralba Service Company

PARTIAL SALVAGE of a corroded tubing string is made possible through use of a cutter which rips out a section of the threaded end of a pipe joint, allowing the string to be backed off at that point and new pipe run to replace the corroded area. The method avoids the use of macaroni strings and consequent problems and maintains full tubing bore to producing zone.

ONE of the major problems of stripper well operators has been to restore water intake pressures after corrosion has eaten through the water intake tubing. Up to the present the only known remedy for this condition has been the use of macaroni strings or installation of smaller diameter pipe inside the corroded tubing.

A tubing cutter primarily designed to operate inside water intake tubing in stripper fields where water pressures have declined due to corroded pipe has been successfully tried out in about 50 wells in the Allegany stripper field of New York. The device, invented by Clarence Bailey of Allentown, N. Y., has the unique feature of cutting the pipe from the inside at the collar without damaging the threads of the collar itself. Tests have been made in 1½- and two-inch tubing and tools are being perfected for larger pipe which, if successful, may be used to salvage tons of second-hand casing in old wells which cannot now be recovered.

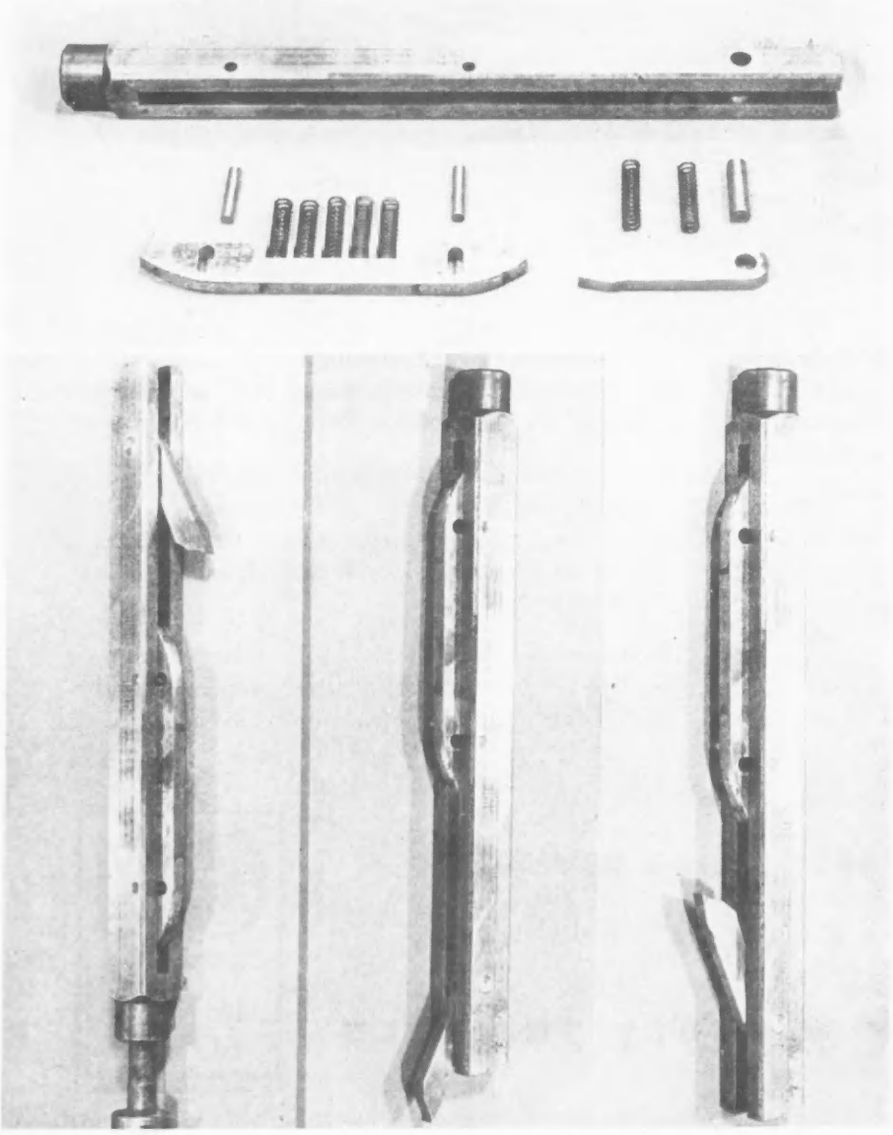


FIGURE 1. Tubing cutter designed to cut pipe inside collar without damaging collar threads. When it reaches a point above the collar it breaks through the tubing and trips. Mechanism is then pulled to top, leaving undamaged collar ready to receive new tubing joint.

Successful application of the tubing cutter necessitates replacement of corroded joints only and thus saves a full string of smaller-diameter tubing.

The cutting knife and its mechanism (Figure 1) is lowered into the tubing on the end of a braided wire line such as used by a shooting crew. The depth is measured on the line and when the tool reaches the desired depth, the winch is reversed and the cutting tool pulled slowly upward. Tension on the line shows when the knife has engaged a joint and at this point the cut is ready to begin.

A tension spring on the side of the mechanism holds the tool in place and the wire line is pulled taut. Two men grasp the line and in a series of jerks pull the cutting tool up through the tubing inside the collar. A slot about one-quarter-inch wide is cut in the tubing (Figure 2). When the tool has cut well beyond the top of the collar it works through the tubing itself and is so designed that it turns downward and is released. The slot in the end of the tubing together with the pressure of the cutting operation loosens the joint so

that it can easily be unscrewed and the disengaged string of tubing pulled to the surface. Good tubing can be salvaged and new tubing added and lowered into the well with a pressure-tight new joint effected in the undamaged collar (Figure 3).

The problem of making a quick and certain new joint is solved by use of a special bell nipple attached to the end of the new string of tubing. This bell nipple is nearly the same diameter as the hole and as it drops over the tubing left in the hole, it steers the old string to perfect connection with the new string being lowered from the surface. The new joint is screwed up tight and the tubing is ready to go back on pressure.

In the nearly 50 test cuts made in the Allegany field an examination of corroded tubing removed from the wells revealed that corrosion had taken place between the level of the highest water table and the lowest water table. Tubing which was completely surrounded by water at all times was in good condition.

For an effective cutting job the hole must be in good condition and a good clean-out job is necessary before the tubing cutter can operate efficiently. This is necessary in order to permit free passage of the cutting mechanism down the tubing and out again after the cut has been made. In the event the operator overruns the depth at which the cut is to be made, the mechanism can be lowered to the bottom of the well dropping through the seat where the cutting knife automatically trips down. The device is brought to the surface and lowered again to proper depth.

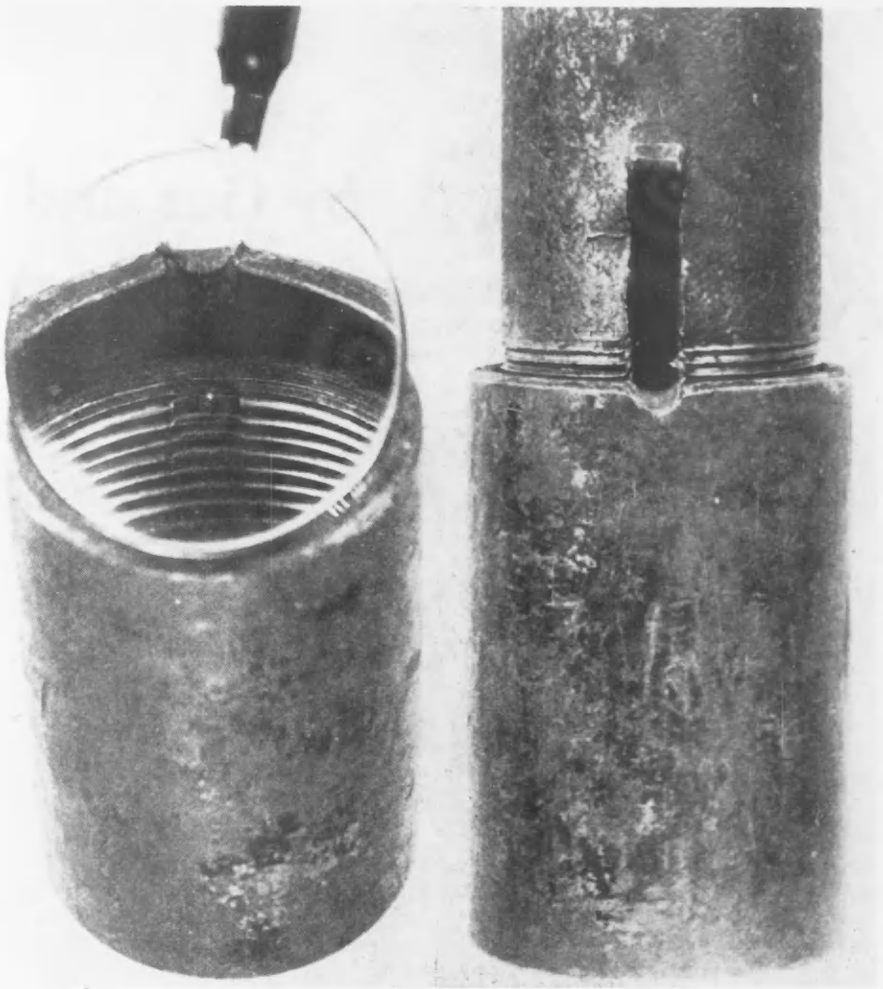


FIGURE 2 (right). Section of pipe and a collar after the cut is effected. Pipe is now ready to be disengaged from collar.

FIGURE 3 (left). Magnified view of interior of undamaged collar. Field tests show that new pipe inserted in the collar results in a pressure-tight fitting.

Insuring V-Belt Service Life

■ CONTINUED FROM PAGE 166

belt drives. However, all belts in a matched set need not have exactly the same inspection number. The following indicates the limits for belt lengths.

Belts up to 100 inches in length should come within 1 inspection number.

Belts 100 to 200 inches in length should come within 2 inspection numbers.

Belts 200 to 300 inches in length should come within 3 inspection numbers.

Belts 300 to 400 inches in length should come within 4 inspection numbers.

Belts 400 to 500 inches in length should come within 5 inspection numbers.

Belts 500 to 600 inches in length should come within 6 inspection numbers.

This means that a set of C120 belts may consist of inspection numbers of two points (e.g. 51 and 52). A set of D360 belts should carry not more than four points (e.g. 52, 53, 54, 55), etc. Usually, sets are matched well within these limits. A set of D360 belts, for example, will probably carry only two inspection numbers when shipped from stock.

Even after installing matched belts, some operators are surprised to find that some of the belts sag while others are tight. This appearance makes them wonder if, while pulling the sagging belts tight, they will not be overstretching the others. There is no need to worry on this score. The difference in length of belts between two consecutive inspection numbers is only one-tenth inch. Examination of the above will show that the maximum length difference allowed between the shortest and the longest belt in a matched set is one-tenth of an inch per 100 inches, or one-tenth of one percent. Stretching the shortest belt of a set this small amount will not harm the belt.

Actually, the amount of sag observed is very misleading. On a center distance of 100 inches, a sag of two inches will appear to be very drastic, but it can be removed by only 0.054 inches of takeup on the motor base—less than one-sixteenth inch! The table gives the amount of takeup required to remove various amounts of sag.

TAKEUP TABLE (In Inches)

Centers in Inches	Sag (In Inches)						
	½	1	2	3	4	5	6
20	.037	.130	.513	1.08			
30	.025	.095	.343	.78	1.51		
40	.010	.074	.240	.59	1.03	1.61	
50	.008	.028	.20	.44	.83	1.27	1.86
75	.004	.018	.17	.30	.60	.87	1.25
100		.025	.054	.12	.40	.66	.94
200			.03	.06	.21	.37	.42
300				.035	.16	.29	.35

So the procedure to keep in mind is very simple. All sag should be removed from belts first, then ½ of 1 percent actual stretch should be added, and this tension should be maintained on the belts at all times. If a "saggy" V-belt will last a year, then proper tension will usually extend this life 4 or 5 times or more. No other factor is so important as proper tension in obtaining full service from today's improved V-belts, the best that have ever been made.

Oil Production by Gas and Flooding

Part 2

By PARK J. JONES
Consultant, Houston

VAPORIZATION in oil reservoirs may be estimated with the aid of K values when reservoir pressure is low enough. For high pressure, composition and volume factors may be obtained by the Sage and Lacey method. The latter procedure is reviewed in this article.

A declining reservoir pressure below the saturation pressure for an oil causes vaporization. The composition of a reservoir liquid changes and its volume decreases. One approach to estimating composition and volume in reservoirs is based on the procedure developed by Sage and Lacey.[1,2,3]

Production is passed through one or two separators. The stock tank liquid obtained from a given production under fixed separator conditions is called oil. Samples of the oil and of the corresponding gas and liquid from the primary separator are sent to a laboratory where the respective compositions are determined. Separator gas and separator liquid are combined in various proportions. The volume of gas phase and liquid phase at reservoir temperature are observed for various pressures.

The Sage and Lacey procedures for estimating gas-oil ratios and volume factors are in terms of the oil obtained from a given composition of production. But a declining reservoir pressure below the saturation pressure for an oil is accompanied by increasing gas-oil ratios; that is, by a change in the composition of production. The latter, in turn, changes the composition of an oil. So computations based on a fixed composition of an oil involve an approximation.[3]

Computations are on a gravimetric basis and require numerous symbols. On a molal basis, the symbols FZ, VY and LX are used extensively. So the molal symbols are retained insofar as possible for gravimetric computations. Thus, F and Z refer to a composite or production. A gas phase is denoted by Y and a liquid phase which is not a composite by X. A weight fraction is denoted by W.

PROPERTIES OF OIL 'A':

Let Q_t be the rate of oil production, tank liquid, in barrels per day. The composition of the oil is obtained from a laboratory and is relative to a given composition of production and fixed separator conditions. The specific volume V_t of the oil is also taken. Accordingly, the weight rate U_t of oil production in pounds per day is defined by

$$U_t = 5.615 Q_t / V_t \qquad (1)$$

Table 2-1 gives the properties of oil 'A'. The X_{it} column shows the molal composition. The product of moles and molecular weight gives the relative weight. There are 210.675 pounds per mole of oil. The last column gives the weight composition. The rate of oil production is 49.8 barrels per day or 5.615(49.8) cubic feet per day. The latter divided by the specific volume of the oil at standard conditions gives 14,564 pounds per day for the weight rate of production.

PROPERTIES OF SEPARATOR LIQUID 'A':

Let W_{7t} equal the weight fraction of heptanes plus in oil. Denote weight fraction of heptanes plus in the primary separator liquid which yielded the oil by W_{7s}. Assume that the heptanes plus in the oil are the same as those in the separator liquid. Then the weight U_s of separator liquid production in pounds per day is defined by

$$U_s = U_t W_{7t} / W_{7s} \qquad (2)$$

where U_t is the rate of oil production in pounds per day.

Table 2-2 shows the composition of

TABLE 2-1
Properties of Oil "A"

Component	X_{it}	M_i	$M_i X_{it}$	W_{it}
C_3	0.0161	44	0.708	0.0034
IC_4	0.0099	58	0.574	0.0027
NC_4	0.0125	58	0.725	0.0034
IC_5	0.0112	72	0.806	0.0038
NC_5	0.0133	72	0.958	0.0045
C_6	0.0347	86	2.984	0.0142
C_{7+}	0.9023	226[a]	203.920	0.9680
	1.0000	....	210.675	1.0000

Separator pressure = 102 psia; separator temperature = 78° F.
Oil: 38° API = 0.835 sp. gr. = 0.0192 cu. ft./lb. = V_t
Producing rate = Q_t = 49.8 bbls./day
U_t = 5.615 (49.8)/0.0192 = 14,564 lbs./day
[a] Laboratory data.

TABLE 2-2
Properties of Separator Liquid "A"

Component	X_{is}	M_i	$M_i X_{is}$	W_{is}
C_1	0.0334	16	0.534	0.0027
C_2	0.0113	30	0.339	0.0017
C_3	0.0188	44	0.827	0.0041
IC_4	0.0118	58	0.684	0.0034
NC_4	0.0141	58	0.818	0.0041
IC_5	0.0115	72	0.828	0.0041
NC_5	0.0135	72	0.972	0.0049
C_6	0.0385	86	3.311	0.0166
C_{7+}	0.8471	226[a]	191.444	0.9584
	1.0000	....	199.757	1.0000

U_s = 14,564/(9680)/9584 = 14,709 lbs./day
Properties of Heptanes plus in Oil; 36 API = 0.845 sp. gr.; Sp. vol. = 0.01898 cu. ft./lb.
[a] Assumed.

TABLE 2-3
Properties of Separator Gas "A"

Component	Y_i	M_i	$M_i Y_i$	W_{iy}
C_1	0.9280	16	14.848	0.8340
C_2	0.0379	30	1.137	0.0639
C_3	0.0197	44	0.867	0.0487
IC_4	0.0050	58	0.290	0.0163
NC_4	0.0046	58	0.267	0.0150
IC_5	0.0018	72	0.130	0.0073
NC_5	0.0010	72	0.072	0.0040
C_6	0.0013	86	0.112	0.0063
C_{7+}	0.0007	115[a]	0.081	0.0045
	1.0000	....	17.804 = M_y	1.0000

Separator pressure = 102 psia; separator temperature = 78° F.
Rate of separator gas production = Q_y = 43,940 cu. ft./day.
U_y = 17,804(43,940)/379 = 2,064 lbs./day.
$U_y + U_s$ = 2064 + 14,709 = 16,773 lbs./day.
W_{yf} = 2064/16,773 = 0.123; W_{sf} = 1 − 0.124 = 0.877.
[a] Laboratory data.

JENSEN S-T-R-E-T-C-H-E-S YOUR PRODUCTION DOLLAR

Producers get all the advantages of 29 years of field experience, and manufacturing know-how when they employ Jensen units to lift their oil. Jensens combine low operating and maintenance costs with trouble-free efficiency. This, together with the saving on initial cost, means production dollars stretched . . . profit dollars increased with each barrel.

You can get specific information on Jensen production economy and efficiency by contacting your Jensen dealer or writing Coffeyville. Do it soon. Dollars are shrinking.

JENSEN

Bros. Mfg. Co., Coffeyville, Kan.

Export Office: 50 CHURCH STREET, NEW YORK CITY

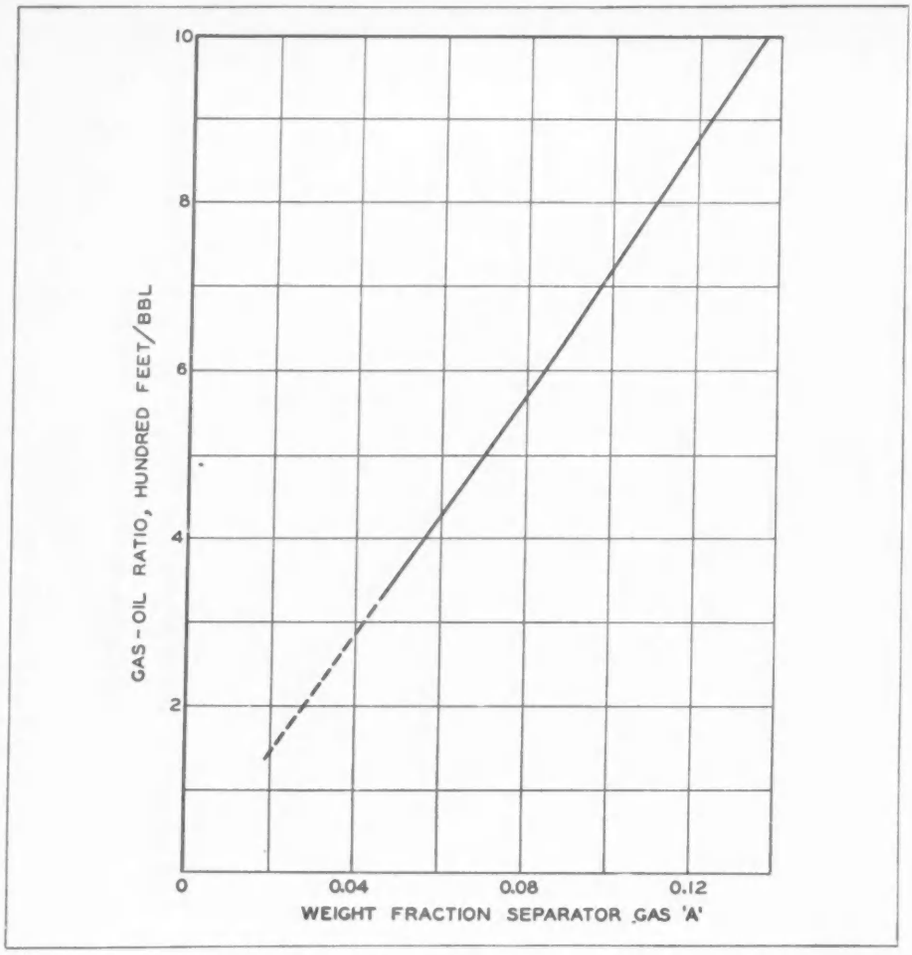


FIGURE 2-1. Gas-oil ratio vs. weight fraction separator gas 'A'.

separator liquid 'A'. The estimated rate of separator liquid production is 14,709 pounds per day.

PROPERTIES OF SEPARATOR GAS 'A':

Let M_y be the molecular weight of the primary separator gas. Let Q_y be the primary separator producing rate in cubic feet per day corrected for temperature, gravity and compressibility. Then the weight rate U_y of primary separator gas production is defined by

$$U_y = Q_y M_y / 379 \qquad (3)$$

The weight fraction W_{yf} of separator gas in production is given by

$$W_{yf} = U_y / (U_y + U_a) \qquad (4)$$

Hence, the weight fraction W_{af} of separator liquid in production is $(1 - W_{yf})$.

Table 2-3 shows the computations for separator gas 'A'. The rate of gas production is 43.94 Mcf per day. The calculated weight rate is 2064 pounds per day. The estimated weight fraction of gas in the production is 0.123.

COMPOSITION OF PRODUCTION 'A':

Let W_{if} be the weight fraction of the ith component in production. It follows that

$$W_{if} = W_{yf} W_{iy} + W_{af} W_{ia} \qquad (5)$$

Table 2-4 shows the calculated composition for production 'A.' Separator gas and liquid were combined in the proportion of 0.123 and 0.877 to obtain the weight composition W_{if} and the molal composition Z_i.

CALCULATED GAS-OIL RATIO:

Suppose production is split into two fluids called gas and oil. The gas consists of the fluids not included in the oil. Consider one pound of production. Assume that the heptanes plus in the oil are the same as those in the separator liquid. Then the pounds of oil U_{tf} per pound of production is defined by

$$U_{tf} = W_{af} W_{7a} / W_{7t} \qquad (6)$$

where W_{af} is the weight fraction of separator liquid in production and W_{7a}/W_{7t} is the ratio of heptanes plus weight fractions in separator liquid to that in oil.

As the specific volume is V_t cubic feet per pound of oil, the barrels B of oil per pound of production is defined by

$$B = U_{tf} V_t / 5.615 = \frac{W_{af} W_{7a}}{W_{7t}} V_t / 5.615 \qquad (7)$$

As gas consists of the fluids not included in oil, the pounds of the ith component U_{iy} in gas per pound of production is equal to the difference between the weight of the component in production and in oil. Thus:

$$U_{iy} = W_{if} - U_{tf} W_{it} = W_{if} - W_{af} W_{7a} W_{it} / W_{7t} \qquad (8)$$

Let V_{iy} equal the specific volume at standard conditions of the ith gas component. The cubic feet C of gas per pound of production is then defined by

$$C = \Sigma(U_{iy} V_{iy}) = \Sigma[V_{iy}(W_{if} - W_{af} W_{7a} W_{it} W_{7t})] \qquad (9)$$

Therefore, if R represents gas-oil ratio in cubic feet per barrel, we have

$$R = 5.615 C / B \qquad (10)$$

Table 2-5 illustrates the calculated gas-oil ratio for production 'A.' The weight composition of production is W_{if} and of oil, W_{it}. There are 0.8683 pounds of oil per pound of production. The calculated pounds of gas is 0.1313 per pound of production. The calculated

TABLE 2-4

Composition of Production from Separator Gas and Liquid

Component	W_{iy}	W_{ia}	$0.123W_{iy}$	$0.877W_{ia}$	W_{if}	M_i	W_{if}/M_i	Z_i
C_1	0.8340	0.0027	0.1026	0.0024	0.1050	16	0.00656	0.5805
C_2	0.0639	0.0017	0.0079	0.0015	0.0094	30	0.00031	0.0274
C_3	0.0487	0.0041	0.0060	0.0036	0.0096	44	0.00022	0.0195
IC_4	0.0163	0.0034	0.0020	0.0030	0.0050	58	0.00009	0.0079
NC_4	0.0150	0.0041	0.0018	0.0036	0.0054	58	0.00009	0.0079
IC_5	0.0073	0.0041	0.0009	0 0036	0.0045	72	0.00006	0 0053
NC_5	0.0040	0.0049	0.0005	0.0043	0.0048	72	0.00007	0.0062
C_6	0.0063	0.0166	0.0008	0.0146	0.0154	86	0.00018	0 0159
C_{7+}	0.0045	0.9584	0.0006	0.8405	0.8409	226	0.00372	0.3294
	.....	.....	.....	.....	1.0000	....	0.01130	1.0000

TABLE 2-5

Calculated Gas-Oil Ratio for Production "A"

Component	W_{if}	W_{it}	$0.8683W_{it}$	U_{iy}	V_{iy}	$U_{iy} V_{iy}$
C_1	0.1050	.....	.....	0.1050	23.61	2.479
C_2	0.0090	.....	.....	0.0090	12.62	0.114
C_3	0.0096	0.0034	0.0030	0.0066	8.60	0.057
IC_4	0.0050	0.0027	0.0023	0.0027	6.52	0.018
NC_4	0.0054	0.0034	0.0030	0.0024	6.52	0.017
IC_5	0.0045	0.0038	0.0033	0.0012	5.27	0.006
NC_5	0.0048	0.0045	0.0039	0.0009	5.27	0.005
C_6	0.0154	0.0142	0.0123	0.0031	4.40	0.014
C_{7+}	0.8409	0.9680	0.8405	0.0004	3.30[a]	0.001
	1.0000	1.0000	.....	0.1313	....	C = 2.711

$W_{af} = 0.877$; $W_{7a} = 0.9584$; $W_{7t} = 0.9680$
$U_{tf} = 0.877(0.9584)/0.9680 = 0.8683$
$B = 0.8683(0.0192)/5.615$; $R = 5.615(2.711)/0.8683(0.0192 = 913$
[a] $379/115 = 3.30$.

ALL-WEATHER

TRUCK TRACKS

ECONOMICAL . . .
Amazing low price puts TRUCK TRACKS within the reach of every truck owner.

$235 Tandem Axle set

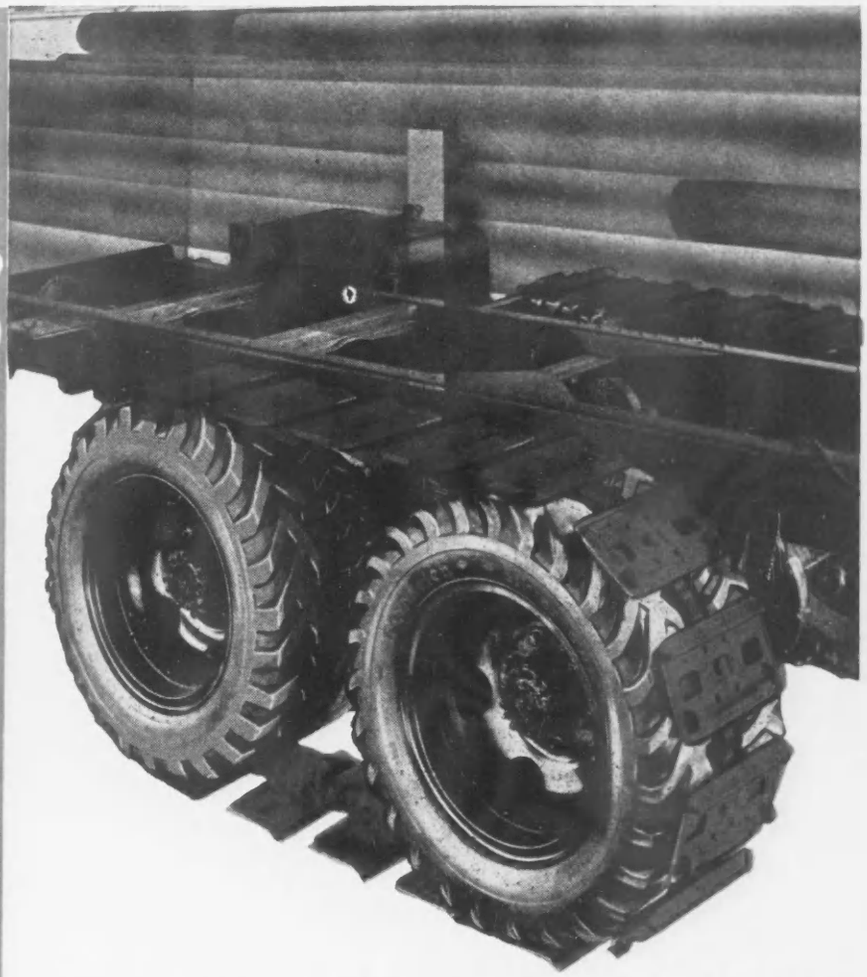
$120 Single Axle set

PROVEN . . .
Outstanding performance in mud, sand and snow for the past 6 years!

VERSATILE . . .
Super traction for single as well as tandem axle trucks. Fit almost all rear duals.

EVERY PAD A MASTER LINK . . .

Adjusting bolt on every pad assures perfect fit, perfect track tension.



STAY IN THE FIELD

Weather or No!

Beat the Mud and Snow this winter . . . mount TRUCK TRACKS on your hauling rigs. TRUCK TRACKS can eliminate seasonal shutdowns in the field by adding *tractor performance* to your trucks. Ideal for desert operations the year 'round.

Drivers mount TRUCK TRACKS in 10 minutes time; remove them in less. Adjustments are simple and easy to make. Nothing to break, bend or loosen . . . maintenance is negligible.

TRUCK TRACKS are easy to order, too! Just send tire size; whether single or tandem axle. Accompany order with a check for $50.00 per set, and your TRUCK TRACKS will be shipped C.O.D. the day your order is received.

WO-12

P & G SUPPLY CO., 615 S. E. Market St., Portland 14, Oregon

☐ Please ship C.O.D. immediately:

_____Sets of TRUCK TRACKS for Single Tandem axle _____x_____tire size

(Check for $50.00 per set deposit enclosed.)

☐ Rush further details.

NAME_____

ADDRESS_____

CITY_____ STATE_____

Shipping Instructions_____

P&G SUPPLY CO.
615 S. E. Market Street
PORTLAND 14, OREGON

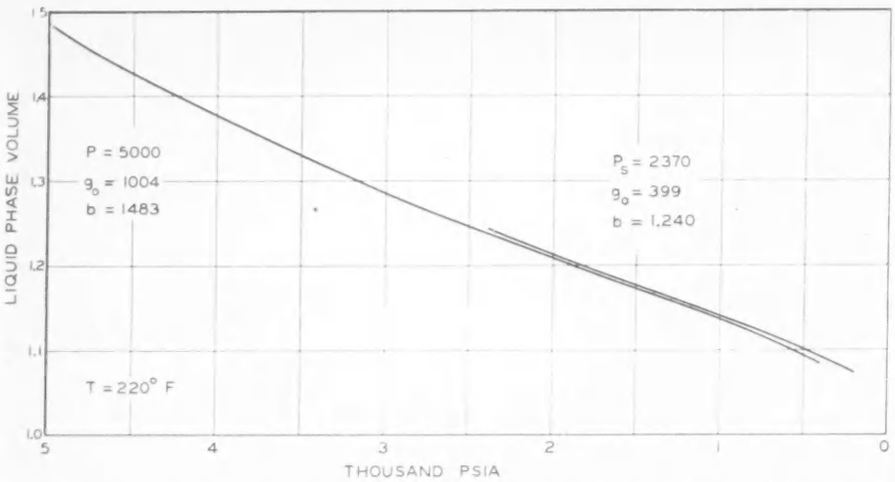


FIGURE 2-2. Volume of liquid phase vs. pressure for a gas-oil ratio of 399 and 1004 per barrel of oil 'A'. (After Sage and Lacey.)

gas-oil ratio is 913 cubic feet per barrel of oil.

In the laboratory, gas-oil ratios are calculated for several weight fractions of separator gas. Figure 2-1 illustrates the variation of gas-oil ratio with weight fraction of separator gas 'A.' The weight fraction of separator gas which corresponds to a field gas-oil ratio defines the composition of production.

VOLUME FACTOR FOR RESERVOIR LIQUID:

The volume factor for oil is the ratio of the volume at reservoir conditions to one volume of oil at standard conditions. The composite volume factor is relative to reservoir gas and reservoir liquid at pressures less than the saturation pressure for an oil. At pressures substantially less than the saturation pressure for an oil, a small fraction of a barrel of oil may be vaporized.

Figure 2-2 shows the volume factor for oil 'A' at 220° F. reservoir temperature. One barrel of oil 'A' and the weight fraction of separator gas 'A' for which the gas-oil ratio is 1004 cubic feet per barrel has a 5000 pounds per square inch absolute saturation pressure. The corresponding volume factor is 1.483 barrels per barrel of oil.

On the other hand, one barrel of oil 'A' and the weight fraction of separator gas 'A' for which the gas-oil ratio is 399 cubic feet per barrel has a 2370 psia saturation pressure. The corresponding volume factor is 1.240 barrels per barrel of oil.

The difference between the two bubble-point curves in Figure 2-2 indicates that a small fraction of the fluid called oil 'A' would be in a reservoir gas. The difference is small for a pressure decline from 5000 to, say, 1000 psia. The data in Figure 2-2 were obtained in a laboratory under conditions for which gas phases were in equilibrium with liquid phases. But a declining reservoir pressure below the saturation pressure for an oil is accompanied by increasing produced gas-oil ratios. So the remaining reservoir liquid is not in equilibrium with all the gas which vaporized. This is called differential vaporization. The quantity of vaporized oil is less under differential than under equilibrium conditions. There is less gas per barrel of oil in a reservoir than there is for equilibrium conditions in a laboratory.

Evidently, differences between equilibrium bubble-point curves exaggerate as far as reservoir conditions are concerned provided the latter are remote from the critical region for the in place fluids. Therefore, the composition of a reservoir liquid defined by arbitrarily chosen gas-oil ratios is likely to be on the conservative side. Similarly, the liquid phase volume experimentally determined in a laboratory for arbitrarily chosen gas-oil ratios is likely to be on the conservative side.

Let V_b be the specific volume at reservoir temperature and saturation pressure for a given weight fraction of a separator gas. Then for practical purposes, the volume factor b for a reservoir liquid is defined by

$$b = V_b / U_{tf} V_t \qquad (11)$$

where U_{tf} is the pounds of oil per pound of composite and V_t is the specific volume of the oil. For instance, b equals 1.483 and 1.240 at 5000 and 2370 psia respectively in Figure 2-2.

VAPORIZATION ABOVE 1440 PSIA

Suppose the saturation pressure for oil 'A' were 5000 psia. Table 2-6 shows the approximate composition. The methane, ethane and propane content decreases. Whereas, the mole fraction of butanes and heavier continues to increase for a pressure decline to 1440 psia.

The laboratory data for this example did not include any points below 2370 psia. On the other hand, K values for pressures above 2000 psia are uncertain. So the composition for a 0.030 weight fraction separator gas was calculated, last column in Table 2-6.

In Table 2-7, K values were applied to estimate the bubble-point pressure. The first column of K values is for 1600 psia. As Σ (KZ) is less than unity, the saturation pressure is less than 1600. The second column of K values is for 1400 psia. But Σ (KZ) is greater than unity. The saturation pressure is slightly higher and is estimated to be 1440 psia. In order to illustrate vaporization in reservoirs at low temperature, the composition shown in the last column of Table 2-6 will be vaporized differentially in the next part of this series.

REFERENCES

[1] Sage and Lacey, "Volumetric and Phase Behavior of Hydrocarbons," Stanford University Press, Stanford, Calif., 1939.
[2] Sage, Hicks and Lacey, API, 1938 and 1941.
[3] Olds, Sage and Lacey, The Oil and Gas Journal, Jan. 19, 1946.

TABLE 2-6

Approximate Properties of Reservoir Liquid "A" at 220° F.

COMPONENT	MOLE PERCENT						
C_1	60.20	57.83	53.67	52.27	47.02	38.79	26.41
C_2	2.82	2.75	2.63	2.59	2.43	21.8	1.83
C_3	1.94	1.93	1.93	1.93	1.92	1.91	1.83
IC_4	0.75	0.77	0.80	0.81	0.85	0.91	1.07
NC_4	0.81	0.83	0.88	0.89	0.95	1.03	1.22
IC_5	0.53	0.56	0.60	0.62	0.68	0.77	0.92
NC_5	0.55	0.59	0.64	0.66	0.74	0.85	1.07
C_6	1.49	1.59	1.75	1.82	2.04	2.38	2.90
C_{7+}	30.91	33.15	37.00	38.41	42.37	51.18	62.75
W_{of}	0.13645	0.12374	0.1048	0.09859	0.0796	0.05611	0.030
P_s	5000	4770	4030	3830	3190	2370	1440[a]
g_o	1004	901	753	705	565	399	215[b]
b	1.483	.....	.....	1.365	.....	1.240	1.173[b]

[a] See Table 2-7; [b] Estimated from Figure 2-1; [c] Estimated from Figure 2-2.

TABLE 2-7

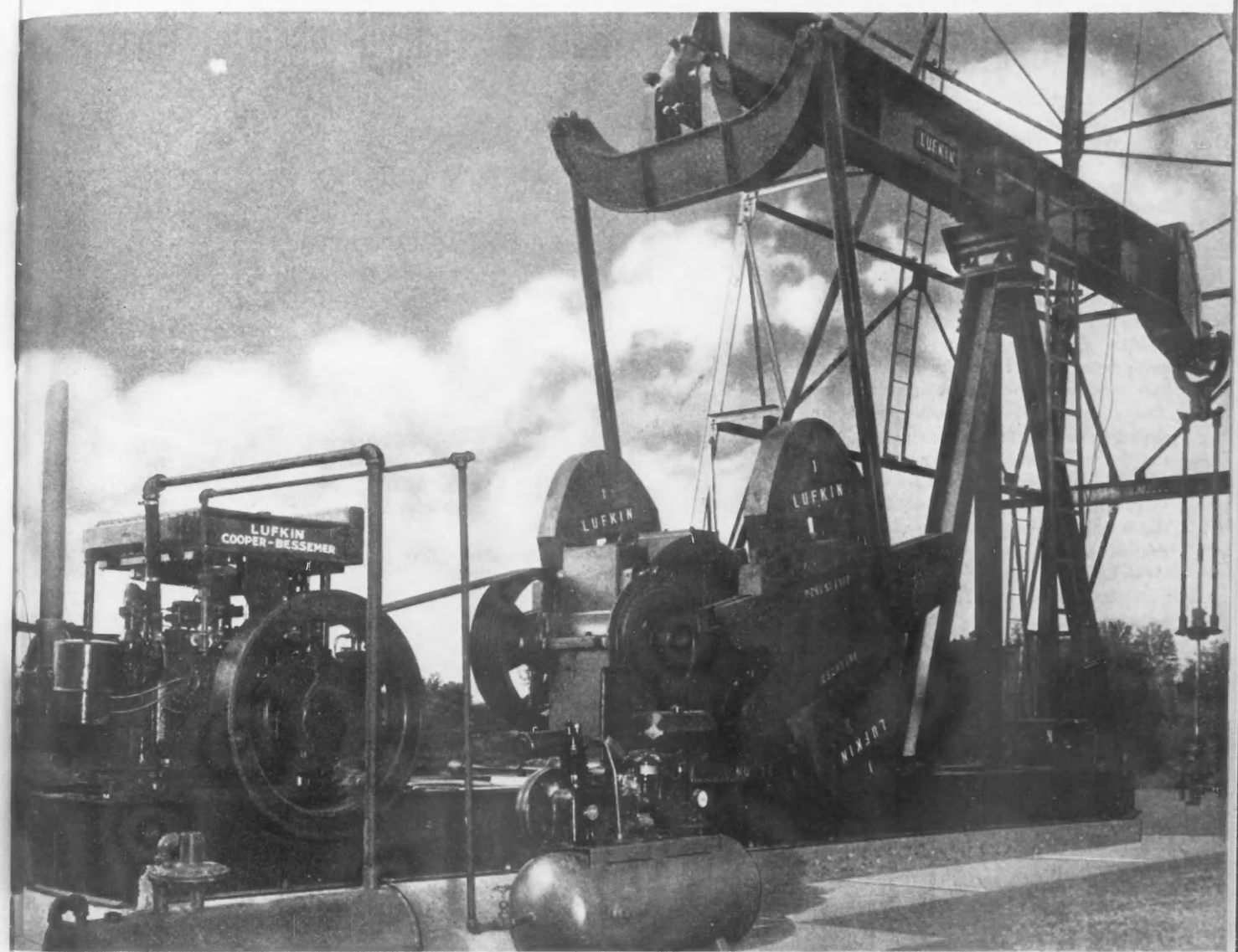
Estimated Saturation Pressure for 0.03 Weight Fraction Gas

	Z_i	K^a	KZ	K^b	KZ
C_1	0.2641	3.3	0.8715	3.6	0.9508
C_2	0.0183	1.2	0.0220	1.4	0.0256
C_3	0.0183	0.70	0.0128	0.72	0.0132
IC_4	0.0107	0.51	0.0055	0.51	0.0055
NC_4	0.0122	0.40	0.0049	0.40	0.0049
IC_5	0.0092	0.26	0.0024	0.25	0.0023
NC_5	0.0107	0.23	0.0025	0.22	0.0024
C_6	0.0290	0.13	0.0038	0.13	0.0038
C_{7+}	0.6275	0.01	0.0063	0.0092	0.0058
	1.0000	.....	0.9317	.....	1.0143

Estimated saturation pressure = 1440 psia.

[a] At 220° F. and 1600 psia; [b] At 1400 psia.

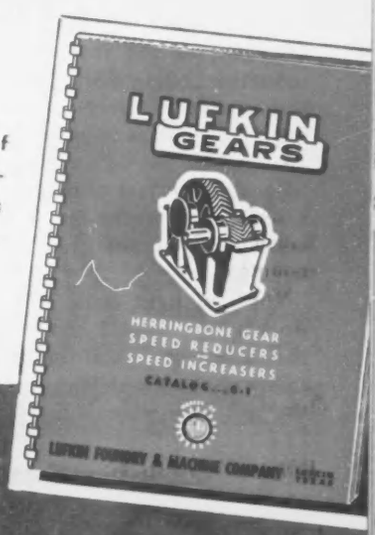
LUFKIN *Pumping Units*



ALWAYS A TOP PERFORMER . . .

always operating at top efficiency—always low in maintenance. You can depend upon Lufkin Units for long, trouble-free service. Lufkin Units, installed more than a quarter of a century ago, are still performing daily with hardly any noticeable difference since original installation.

We manufacture a full line of commercial speed reducers and increasers. More than 60,000 sets have been produced in our Lufkin plant. Send for catalog today.



LUFKIN FOUNDRY & MACHINE COMPANY

LUFKIN, TEXAS

Branch sales and service Houston, Dallas, New York, Tulsa, Los Angeles, Seminole, Oklahoma City, Corpus Christi, Odessa, Kilgore, Wichita Falls, Casper, Wyoming; Great Bend, Kansas.

How to do it!

PRODUCTION HINTS

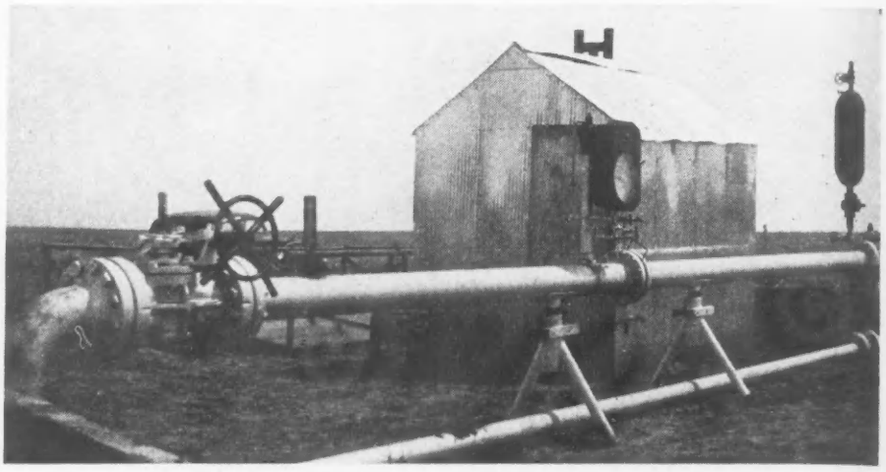
$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

HOW TO—Effectively Thaw Frozen Hydrates Lodged in Meter Runs

Simple and effective thawing of frozen hydrates lodged in the meter runs of natural gas orifice meters can be accomplished by injecting commercial methyl alcohol or some de-icing fluid directly into the up-stream section of the meter run.

For injecting the de-icing fluid, one operating pipe line company had their welder construct a gravity feed lubricator from a three-foot length of eight-inch pipe and some one-inch pipe fittings. The ends of the eight-inch pipe were closed with orange peel welds to form the barrel of the lubricator. Into each of the barrel ends, a one-by-four-inch threaded pipe nipple was welded, with the lengthwise center axis of each nipple coinciding with the longitudinal axis of the lubricator barrel.

A plug valve was screwed onto the bottom end of the lubricator barrel for regulating the flow of de-icing fluid into the meter run. An ordinary one-inch gate valve with a short nipple projecting upward to accommodate the end of a funnel to be used while filling the lubricator barrel was screwed onto the nipple welded into the top end of the lubricator barrel. An air vent to permit escape of air during the process of filling the lubricator barrel, was made by welding a short one-fourth-inch pipe nipple diagonally into the upper end of the lubricator barrel. A stop cock was attached to the end of this one-fourth-inch nipple.



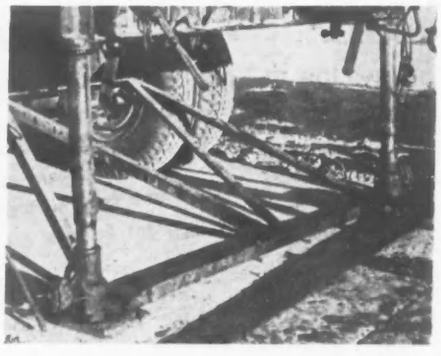
In the illustration, the lubricator was attached to the blow down on the upstream side of the meter run. By using meter flanges with tapped holes directly opposite each other on the outside circumference of the flange, a drain for the escape of liquid was made by attaching a short nipple and a stop cock to the bottom side of the upstream flange.

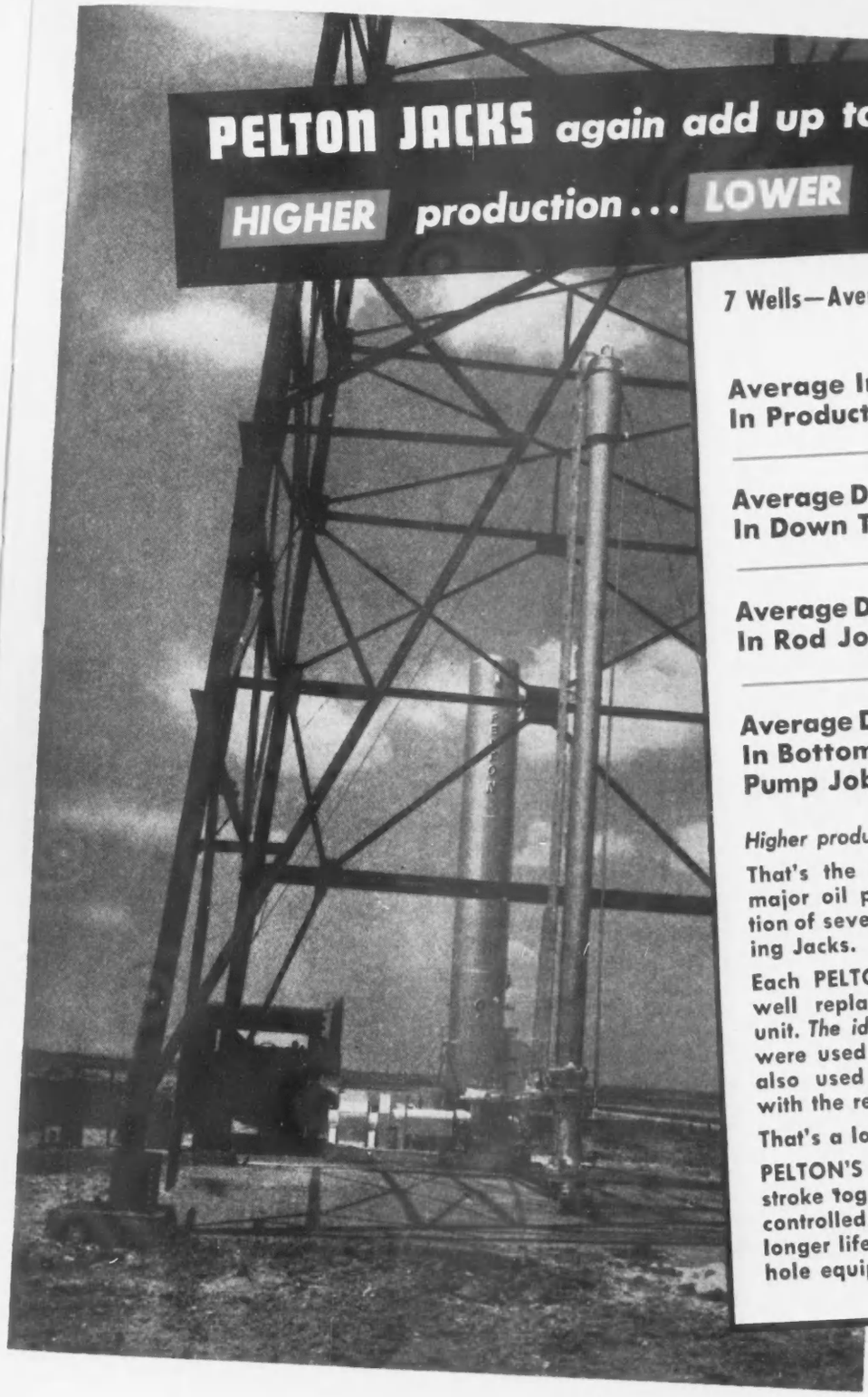
Such a method of de-icing troublesome frozen meter run straightening vanes was found to be very effective during the low temperature periods of winter, just at times when it is most desirable to keep every channel open to the flow of gas on a pipe line system.

HOW TO—Install Supporting Base on Truck-Mounted Pulling Unit

To provide increased stability and strength for the rear end of a truck-mounted pulling unit and at the same time reduce setting-up costs at each well, one company made up a framework which extends at an angle from a hinged point just above the rear most truck axle down to the steel pads upon which the hydraulic levelling jacks are mounted.

Made of light angle iron, the framework forms a rigid connection between the truck chassis and the base pads, and eliminates much shifting or bouncing of the hoist unit when it is pulling a heavy load. During travel between wells, the framework is drawn up and secured by latching to the underside of the bed frame. Similarly, the two adjustable legs to which the hydraulic jacks are attached are hinged to the underside of the bed corners so that when the rig is moved, these members may be folded up and inward, then latched in a horizontal position by means of a bolt run through matching eyes in both legs and ears, the latter welded to the under side of the bed frame. The entire installation, while inexpensive to make up and install on a pulling unit, nevertheless materially cuts down setting-up and tearing-out time at each well.





PELTON JACKS *again add up to...*

HIGHER production... LOWER costs!

RECORD

7 Wells—Average Pump Setting 7000'

Average Increase In Production	15%
Average Decrease In Down Time	35%
Average Decrease In Rod Jobs	85%
Average Decrease In Bottom Hole Pump Jobs	74%

Higher production . . . lower costs!

That's the field record shown by a major oil producer after the installation of seven PELTON Hydraulic Pumping Jacks.

Each PELTON unit was placed on a well replacing a Mechanical Beam unit. *The identical sucker rod strings* that were used with the Beam units were also used with the PELTON JACKS with the results shown above.

That's a logged record!

PELTON'S 20 foot constant velocity stroke together with fewer and softer controlled rod reversals guarantee longer life for sucker rods and bottom hole equipment.

Whether your pumping depth is 2,000 feet or 12,000 feet, PELTON Engineers have facts and figures to prove how a PELTON JACK increases production—decreases costs. Write now for Bulletin No. 38.

PELTON

LONG-STROKE HYDRAULIC PUMPING JACK

REG. U. S. PAT. OFF.

BLW THE BALDWIN GROUP

THE PELTON WATER WHEEL COMPANY

2929 NINETEENTH STREET • SAN FRANCISCO 10, CALIFORNIA

SUBSIDIARY OF THE BALDWIN LOCOMOTIVE WORKS

DISTRICT OFFICES IN HOUSTON • ST. LOUIS • SAN FRANCISCO • NEW YORK • OTHER PRINCIPAL CITIES

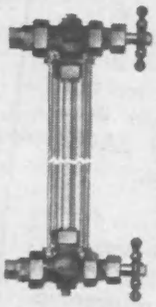
PENBERTHY
Liquid Level GAGES

REFLEX

Reflex type complete with gage valves. Liquid shows black—empty space shows white. Liquid level is always unmistakable.

TRANSPARENT

Transparent type complete with gage valves. Used where through vision is desired under high pressures and/or temperatures.

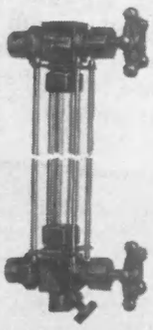


DROP FORGED STEEL

Tubular glass type, Chrome-Moly temperature resisting steel body, stainless steel trim, regrinding removable seats.

ALL IRON

Tubular glass type, extra heavy body of special high strength alloy iron, shanks alloy steel, trim stainless steel, valves self-cleaning.

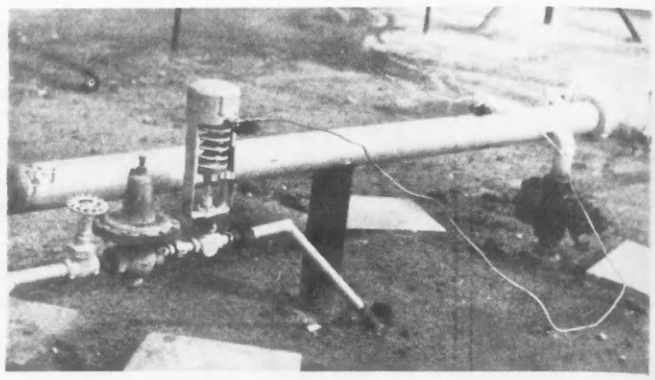


There is a Penberthy Gage of superior quality for every liquid level gage requirement. Gages are fabricated to customer's specifications from special alloys to meet unusual corrosive and temperature conditions. All Penberthy Gages conform with API-ASME requirements.

3277-B

PENBERTHY INJECTOR CO.
Detroit 2, Mich.
Canadian Plant — Windsor, Ontario

HOW TO—Assure Control of Indirect Gas Heater

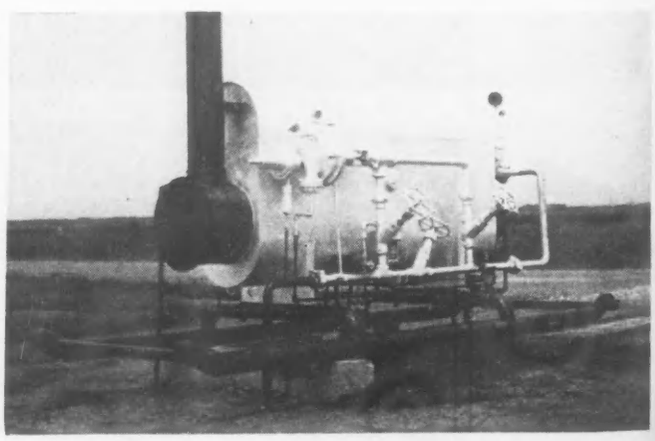


In high-pressure gas-distillate fields, freezing of hydrates in regulators presents a serious problem. Heating the gas that has been separated from the distillate has eliminated this problem. The high-pressure gas was first put through an indirect heater before the pressure was reduced. During cold weather, more heating was required than during summer months. Consequently, firing the heater with a minimum amount of heater fuel posed a problem. The gas, at reduced line pressure, was sold to a gas company and was measured prior to entering the gas company's gathering line. It was desired to keep the temperature of the gas entering the meter run as near 70° F. as possible to eliminate excessive meter corrections.

The problem was solved by a thermostat which operated on the gas temperature in the meter run. The thermostat was placed in the gas line feeding fuel to the indirect heater. This fuel gas came from the low pressure separator and had to be further reduced in pressure before feeding into the heater. The regulator just upstream of the thermostat provided this reduction in pressure.

Gas entering the indirect heater was heated to such a temperature that when it passed through the regulators, it entered the meter run at about 70° F. When the gas in the meter run exceeded this temperature, the thermostat closed the heater fuel gas line until the temperature dropped below the desired value. This system is simple and has functioned satisfactorily. The thermostat element is placed in a lateral welded to the meter run as shown. All equipment is above ground and conveniently located for ease of inspection and repairs.

HOW TO—Put Gas Volume Tank in Heater Skid



Field equipment that is skid-mounted can be handled with considerable ease and with less wear and tear on unprotected parts. The indirect gas-fired heater shown has been permanently mounted on a skid frame made from four-inch pipe. Although this particular installation is of a semi-permanent nature, the skids remain on the heater as an integral part of the equipment.

The integral skid frame serves two purposes. It provides a means of handling the heater with ordinary field trucks

Just More "Lugging Power" in AC Engines

Sure, these are just typical oil country pumping installations that can be found on thousands of leases. But these jobs are handled by *slow speed*, tractor-type Allis-Chalmers Power Engine Units.

The high torque and "Lugging Power" of the 5 sizes of Allis-Chalmers engines, make most any pumping job an ordinary one. They are engineered and built to operate in exposed locations . . . you don't have to humor them with constant checking and adjustment.

A COOPER POWER ENGINEER CAN SHOW YOU HOW "MORE LUGGING POWER" IS CHEAPER IN THE LONG RUN.

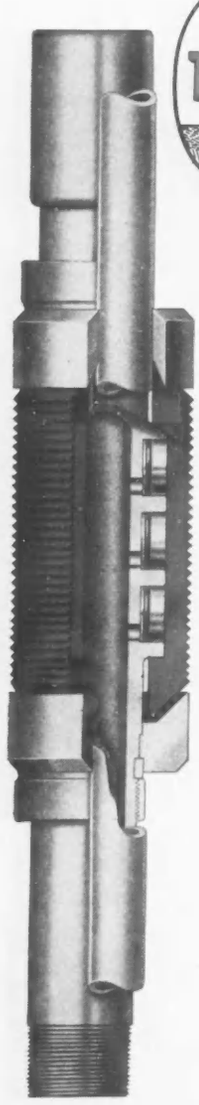
FRED E. Cooper, Inc. TULSA, OKLA.

Phone 5-7191 P. O. BOX 1890

Branches — HOUSTON — Ph. Fairfax 4619 LYNWOOD, Los Angeles — Ph. Newmark 24747

without breaking out all auxiliary connections appurtenant to the unit. In addition to this function, the skid frame also serves as a volume tank for low-pressure field gas used to fire the heater burners. The two longitudinal side members of the skid are made from four-inch pipe which has been turned up at each end where two-inch end braces are welded. The heater rests upon two cross members of four-inch pipe which is elevated above the lateral pieces by the height of a standard 90-degree ell. Burner connections are made to these cross members.

If it is necessary to take the heater into the shop for cleaning or repairing, only a minimum of connections need be broken, and the unit stands ready for shipment at all times, since the skid is part of the heater setup.



PAGE TYPE "C" TUBING ANCHOR

PAGE TENSION TOOLS

NOTE ...TO "FREE PUMP" OPERATORS!

SMOOTH OUT YOUR TUBING TROUBLES with this PAGE TYPE "C" TUBING ANCHOR...

It's *designed* for parallel strings!

The Page Type "C" Tubing Anchor is designed specifically to anchor parallel strings in "Free Pump" installations. Its advantages to operators are many. The Page Type "C" Anchor *assures* a fast tubing run-in without danger of accidentally setting slips, *eliminates* the human element of top-hole manipulation in setting and *saves* valuable time in landing tubing strings. The Page Type "C" *relieves* tubing of fluid and working pressure loads and *increases* the factor of safety in long tubing strings. It enables running longer strings of second grade tubing because the Type "C" *supports* the tubing and holds it in tension, free of "working" loads.

SIMPLE OPERATION

The Page Type "C" Tubing Anchor sets hydraulically on fluid pressure differential. The hydrostatic head of oil in the power string together with the "free pump" surface operating pressure, forces a series of small pistons against v-cut slip segments that grip securely against the casing. Holding power of the slips far exceeds fluid head and operating pressure loads. Release and removal from well requires only drainage of tubing. Tool can be run-in either end up.

SIMPLE CONSTRUCTION

Anchor Body made from a solid billet of steel . . . working force consists of two v-cut slips and six pressure-sealed pistons . . . all parts replaceable and interchangeable.

WRITE now for details or see . . .

Mid-Continent Distributors

D+B Division—Emsco Derrick & Equipment Co., Garland, Texas

The Continental Supply Company Dallas, Texas

PAGE OIL TOOLS, Inc.

3356 Lime Ave., Long Beach 7, Calif.

HOW TO—

Anchor Cattle Guards

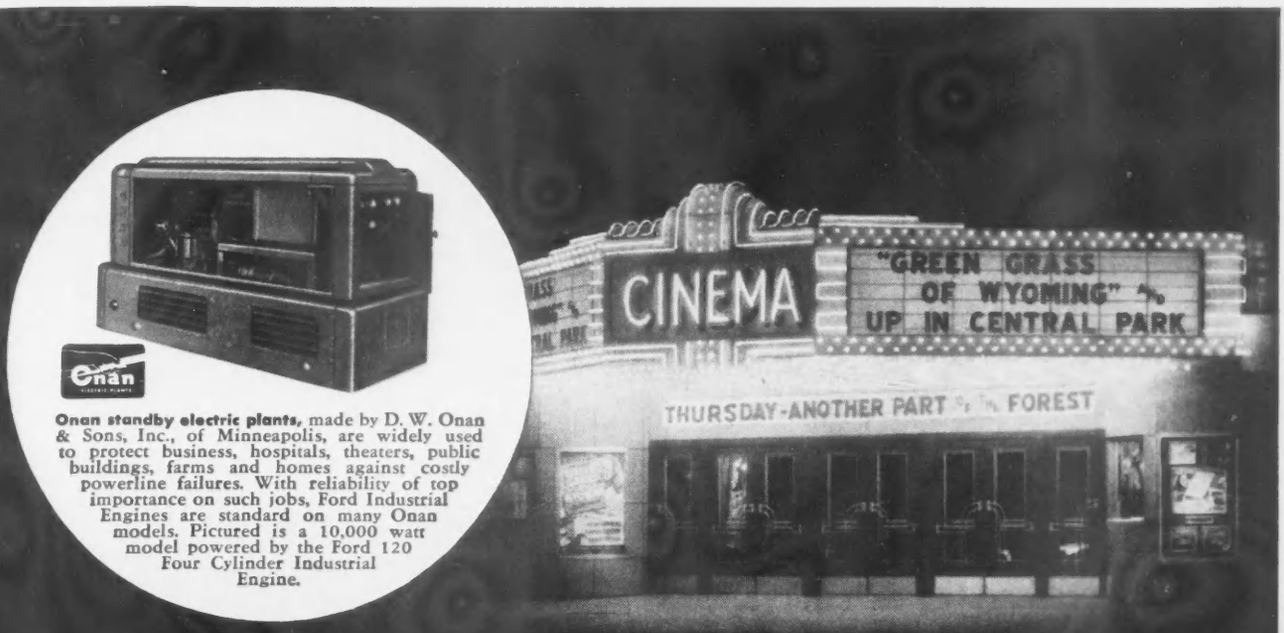
To prevent shifting and vibration of a cattle guard which has to withstand the usual heavy traffic encountered in the field, one company has adopted an anchoring system that not only effectively holds the guard in place, but provides a means of tightening the anchoring device from time to time.

After the guard is set up in the roadway, a short piece of pipe is placed across each end of the unit. By means of wire cables anchored to dead men and a heavy turnbuckle installed as shown in the photograph, the transverse pipe section is made a part of a truss section which effectively holds the guard in position. Periodic tightening of the turnbuckles takes up slack that develops through settling and general vibration occurring when vehicles pass over the guard. This form of anchoring is ideal on temporary installations or where it would not be practical or economical to pour concrete piers or footings.

HOW TO—

Safeguard Fittings

To eliminate the possibility of breaking or twisting off the vulnerable test cocks mounted at intervals up the side of a separator, one company has made it a policy to weld the lower ends of the several lines to a steel plate which has been tacked to the side of the separator shell. The light plate, cut out of 3/16 or 1/4-inch material, is cut to fit the



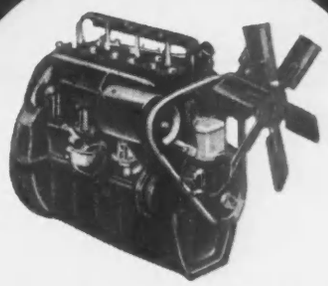
Onan

Onan standby electric plants, made by D. W. Onan & Sons, Inc., of Minneapolis, are widely used to protect business, hospitals, theaters, public buildings, farms and homes against costly powerline failures. With reliability of top importance on such jobs, Ford Industrial Engines are standard on many Onan models. Pictured is a 10,000 watt model powered by the Ford 120 Four Cylinder Industrial Engine.

Use FORD *Industrial Power...*

Be Right 3 Ways!

1. **RIGHT POWER**—your choice of five rugged new models in the Ford Industrial Engine line. There's one *just right* for your power problem.
2. **RIGHT FEATURES**—you're always right up to date when you specify Ford Power. Every model has all the latest benefits of Ford's famed progressive engineering.
3. **RIGHT SERVICE**—as near to you as your Ford Dealer, with complete facilities and "know-how" to keep Ford Industrial Engines on the job for maximum use, lower costs.



Ford 120 Four Cylinder Industrial Engine (120 cu. in. displacement)

Ford **Get acquainted with the new Ford "Power-Family" . . . five great industrial engines—a "four" of 120 cu. in. displacement . . . two "sixes"—226 cu. in. and 254 cu. in. displacement . . . two "eights"—239 cu. in. and 337 cu. in. The *right* power for you, and every one completely new! Send post card today for full specifications and—for power, pick Ford!**

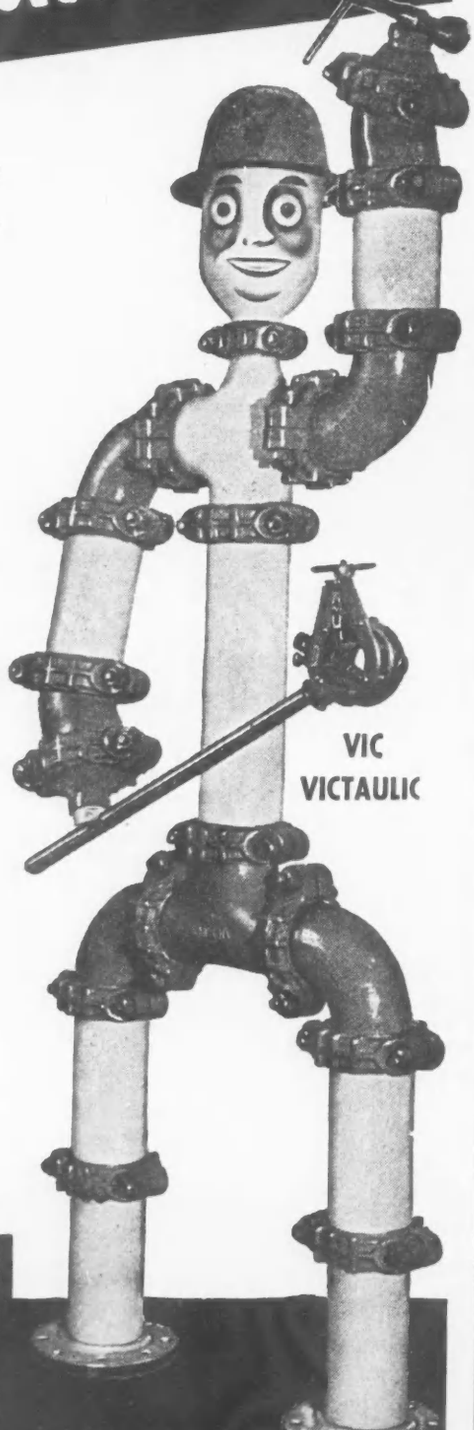
FORD MOTOR COMPANY

INDUSTRIAL AND MARINE ENGINE SALES DEPARTMENT

Dearborn, Michigan

YOUR JOB IS WELL-POWERED WHEN IT'S FORD-POWERED

I'M YOUR MAN



FOR THE *BIG* 3 SAVINGS: MAN-HOURS... MONEY... AND MATERIAL!

TWO-BOLT SIMPLICITY of Victaulic Couplings permits regular, unskilled labor to button up piping systems with just a few fast turns of a standard T-wrench. Also, any valve, fitting, or pipe length can be quickly lifted out for repair or replacement *without backing off* adjoining sections, *without damaging* ends of pipes and fittings!

THESE FEATURES, TOO... with Victaulic Couplings; *Flexibility* for your pipeline—to follow building or land contours without expense of engineered alignment. *Lock-tight, leak-proof* joints under pressure or vacuum... joints that won't pull out or blow off from pressure, vibration, or sag!

FULL-FLOW Victaulic Elbows, Tees, and other Fittings are precision engineered with true circular walls and wide-sweeping turns... *they increase pipe-line delivery and lower pumping costs!*

OUR "VIC-GROOVER" grooves pipe ends twice as fast with half the effort of ordinary pipe threaders!

WRITE TODAY for Victaulic Catalog and Engineering Manual No. 44 . . . and for "Vic-Groover" Catalog No. VG-47.

SELF-ALIGNING PIPE COUPLINGS

VICTAULIC

EFFICIENT FULL-FLOW FITTINGS SIZES—3/4" THROUGH 60"

VICTAULIC COMPANY OF AMERICA

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Victaulic, Inc., 727 W. 7th St., Los Angeles 14, Calif.

Victaulic Company of Canada, Ltd., 200 Bay St., Toronto 1

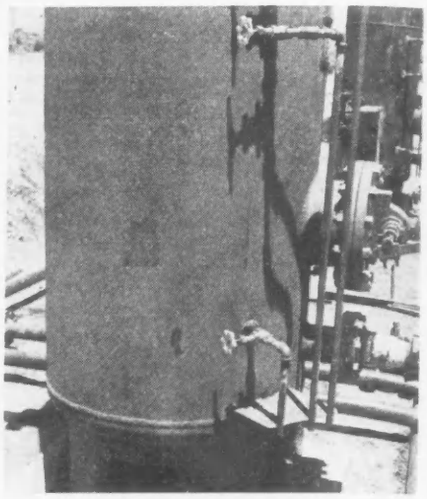
For export outside U. S. and Canada: PIPECO Couplings and Fittings: Pipe Couplings, Inc., 30 Rockefeller Plaza, New York 20, N. Y.

Copyright 1948, by Victaulic Co. of America

PRODUCTION HINTS

contour of the shell and on the front side, it is provided with small half-round notches into which the ½-inch lines are placed and lightly welded in place.

The simple support is inexpensive to install, but the rigidity provided would save many man-hours of work and pos-



sible damage to adjacent equipment if one of the fittings were to be struck hard enough to be broken off between the valve and the shell. Should removal of fittings be desired, the light pipe easily could be cut out and later re-installed in the same plate.

HOW TO—

Lubricate Steam Pump

Where steam pumps are used with natural gas for power, it is important that a flood of lubricant be kept on the pistons and valves. One company mounts the vessel which contains the lubricant directly on top of the power end of the

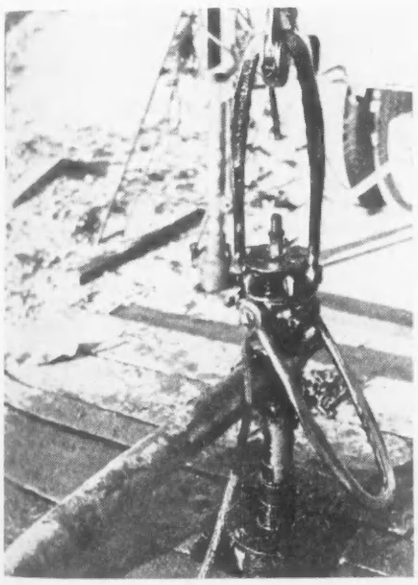
pump. This is accomplished by extending the bolts which hold the valve covering through a plate to which the bottom of the oil chamber is welded. The oil chamber consists of a 12-inch piece of four-inch pipe, with a two-inch collar welded into the top for a filler plug. Two quarter-inch connections are welded into the sides of the four-inch nipple at the bottom and the top. These quarter-inch pipes run through two quarter-inch valves and connect to the inlet line of the pump about three inches apart.

In operation, the upper quarter-inch needle valve is opened wide after the vessel is filled and the cap screwed down. The quarter-inch gate valve on bottom is used to adjust the flow and is cracked just sufficiently to empty the vessel during the eight hour shift.

HOW TO—

Police Rod Elevators

Tubing or rod elevators are among the small tools most likely to disappear from a pulling rig when the unit is shut down for the night unless precautions are taken to put them under lock and

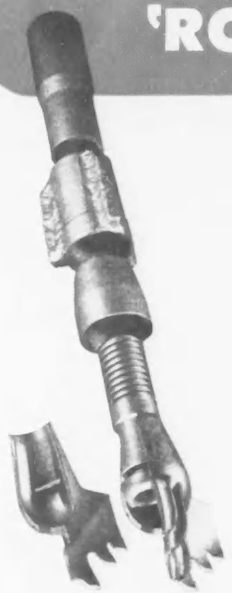


key. One operator has found it convenient, when shutting down at the end of the day with rods or tubing still in the hole, to place both elevators on the well head and then set the weight of the string down on them.

As shown in the photograph, the extra rod elevator is placed under the one still attached to the hook, the weight of the string holding both elevators in place. It would be necessary to start up the engine and hoist the string before a would-be thief could remove an elevator.

for faster... more economical exploration drilling

HAWTHORNE
Replaceable Blade
'ROCK CUTTER' BITS



● FASTER DRILLING

In competitive tests made by one major seismograph operator, Hawthorne Bits drilled 33⅓% more holes per month than conventional type drag bits. These tests, made over a six month period, are representative of favorable reports being received from many users.

● LOWER BIT COSTS

Operators report savings in bit costs over 50%. This is because the replaceable blades last longer and are much more economical than bit service on conventional type drag bits.

● "ON THE DRILL" BIT SERVICE

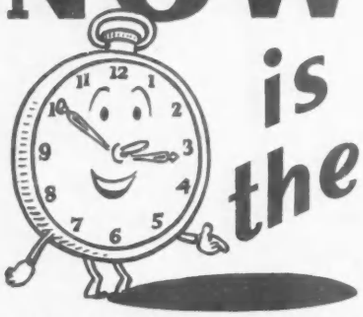
One of the biggest advantages of Hawthorne Bits is that you don't have to send the bit into the shop to be serviced when blades are worn. The blades are replaced "on the drill" — on location. One bit head assembly will last for many sets of blades — many of these bit heads were in service for more than eight months using a total of 192 sets of blades before the bit assembly itself had to be replaced.
This "on the drill" bit service is especially advantageous to foreign operators where repair shops are few and far between.

● ALL FORMATION DRILLING

Hawthorne Replaceable Blade "Rock Cutter" Bits have proved capable of drilling more hole in soft formations in less time than any conventional type drag bit. Furthermore, these blades successfully drill broken formations and many rock formations that have previously required roller bits. This means faster drilling, fewer round trips to change bits and lower bit costs.
Hawthorne Replaceable Blade "Rock Cutter" Bits are your answer to low cost hole making. For full information, write for our bit catalog today.

HERB J. HAWTHORNE INC.
P. O. BOX 7299 HOUSTON 8, TEXAS

NOW is the TIME



To Test

SAND-BANUM

On Better Than a

MONEY BACK GUARANTEE

Automatically and Safely

Sand-Banum automatically and safely removes and prevents boiler scale and corrosion while your equipment operates.

Read This Unconditional Guarantee

We will send you Sand-Banum for trial, charges prepaid, with the distinct understanding that if, at the end of 30, 60 or 90 days, you are not satisfied with results you owe us nothing—only a report.

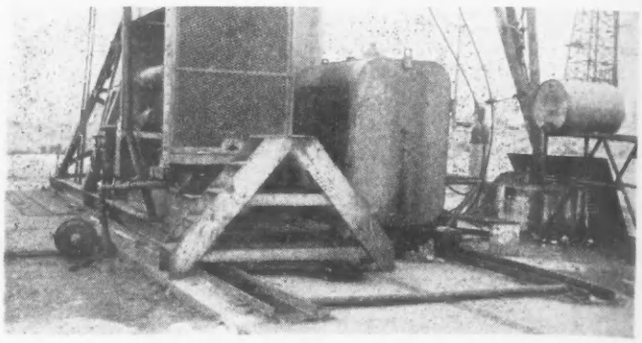
Send for YOUR TESTING MATERIAL Today

"The Entirely Different Boiler and Engine Treatment"

AMERICAN SAND-BANUM COMPANY, Inc.
9 ROCKEFELLER PLAZA, NEW YORK CITY 20

PRODUCTION HINTS

HOW TO—Facilitate Shifting of Pumping Unit



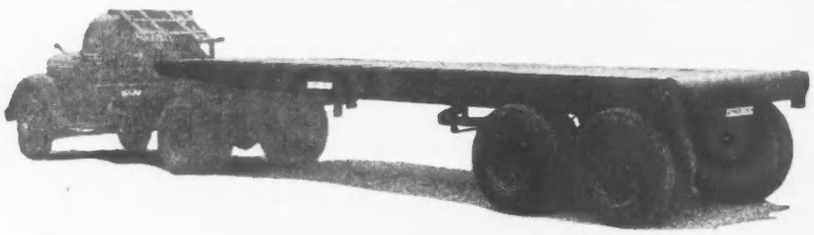
In order to quickly clear the derrick floor area for routine service jobs or pulling on wells equipped with hydraulic-type, long-stroke pumping units, some companies have found it advantageous to mount the entire assembly on a skid base, the latter resting upon a pair of channel iron tracks similar to that illustrated. The channel bases, which extend from the far side of the cellar to eight or ten feet outside the derrick, are anchored in the concrete mat by steel ears welded at intervals along either side of the individual channels.

To prevent movement of the pumping unit when it is set up over the well, anchor bolts are provided which tie the channel irons to ears welded to the top surface of the I-beam skid bases. When the well is to be pulled, the polished rod is disconnected, after which the entire unit may be pulled back out of the way of well pulling operations. Application of a film of oil or grease on the channel surfaces facilitates movement of the heavy unit as it is being moved along the tracks.

On an Oil Field Trailer . . .

"A-M-E-R-I-C-A-N"

Spells DEPENDABILITY!



Behind the American nameplate is a quarter-century of experience in building a complete line of sturdy, dependable oil field trailers—both platform and pole models, of single and tandem axle design. The model SF-42-T nose-loading tandem shown here is an example of American-built platform trailers—designed, engineered and constructed to meet the most rugged hauling tests of the oil industry. We can give fast delivery on these versatile, economically-operated trailers. Let us know your requirements TODAY.

AMERICAN BODY and TRAILER INC.

Main Office— OKLAHOMA CITY 1500 EXCHANGE AVE. • TULSA, OKLA. 5700 E. ADMIRAL PLACE

Branch Offices— NORTH LITTLE ROCK, ARK. 3131 EAST BROADWAY • AMARILLO, TEXAS 740 NORTH GRAND

Arkansas River Pipe Line Crossing

FIGURE 1.—Placing 20-inch river weights in bottom of trench which has been excavated to within 20 feet of the west edge of main Arkansas River channel. Water level in trench is 8 feet, 6 inches below the water level in the river, this being maintained by the sand points and pump system for de-watering the trench.

By E. K. HARTZELL
Assistant to President, Cities Service Gas Company

PIPE line river crossings have become routine to construction engineers. Large diameter lines have been laid successfully across many rivers, including the Mississippi, and in most jobs conventional methods have been applied.

Spanning the sprawling Arkansas River near Hutchinson, Kansas, to provide a link for Cities Service Gas Company's new 26-inch natural gas line from the Hugoton gas field to Kansas City involved an interesting method of "dehydrating" or de-watering the river bed so as to provide an underground "bridge" to protect the pipe from washouts during high water and flash floods.

The new crossing is in the middle section of traditionally dry Kansas where the Arkansas River meanders across the prairies over wide, sandy flats and desert-like tablelands. Sudden cloudbursts often turn this seemingly quiescent river into a destructive, rampaging torrent which within a matter of minutes tops its banks.

CONTROL OF WATER in the trench at river crossings is a serious problem in many cases, and threatened to delay the work on one gas trunk line. Use of sand points to de-water the trench allowed work to be carried on behind dike. Drying of the trench permitted backfill to compact properly before watering and eliminated sandy danger spots.

While construction of the $38 million project which will carry natural gas from the vast Hugoton field to the Kansas City market area progressed as rapidly as delivery of steel pipe permitted, engineers realized that getting the line down and under the Arkansas River was a vital job which had to be done in dry weather. The river crossing at Hutchinson bisects the big line almost in the center of Kansas where the Arkansas carries little or no water during spring and early summer. Aware, however, of the treacherous behavior of the river resulting from unpredictable climatic conditions, pipe line engineers

FIGURE 2.—Putting a section of 20-inch pipe in place and getting a proper "lineup" preparatory to making a "tie-in" weld. River weights ready for placing on pipe are in foreground. Weights were installed 15 feet apart.

took advantage of all protective measures and physical insurance known to modern pipe line building. Spanning the Arkansas was the major river-crossing job and they planned carefully for this important link which, if broken, could spell disaster for the entire system which will be supplying Cities Service Gas Company's expanding markets in the area by 1950.

The Arkansas River crossing is deep beneath the earth's surface and also under water. In this case "under water" means that the twin pipe line sections laid for a distance of more than two miles across the stream bed and adjacent river banks are well below both the low- and high-water levels recorded in the stream-flow records of a river notorious for its extreme periods of dry and flood stages.

While the main line consists of 26-inch diameter pipe, the crossing was effected by laying two parallel 20-inch sections approximately two miles long and 150 feet apart. Because of the water table in the area, it was necessary that the ditch, or trench route, for each of the 20-inch lines be de-watered to permit excavation and laying of the crossing lines. This was effected by the use of sand points connected through a header arrangement. Sand points are sections of small diameter pipe perforated along the sides and water-jetted into the sandy soil. Water in the soil drains into the sand points and pumps set at intervals suck this water from the sand to lower the water table near the ditch line. The pumps are run continuously until the trench is excavated, the welded sections of pipe, with river-weights and anchors, installed and the line back-filled or covered. Points, header and pumps are then removed and relocated on another section of line.

Although the Arkansas River channel is only about 600 feet wide at the site, the crossing was designed to extend approximately 3000 feet west of the river channel and 6000 feet east of the stream bed. A smaller tributary known as Cow Creek is just east of the river, and since this stream has also been known to overflow and cause flood damage, the crossing was extended eastward to forestall erosion and damage should the creek become turbulent.

Beginning on each side of the river, the main 26-inch line was split into a pair of 20-inch lines on the theory and in the hope that if the rains come and the river digs deep into the soil, one of the two lines will hold and service will not be completely interrupted.

Special welding methods were used by the constructing crews on each of the 40-foot sections of the 20-inch pipe to give added strength to the river-crossing tubes. Each welded joint was further strengthened by a steel reinforcing sleeve through the river channel proper and across Cow Creek.

Heavy river weights, each two feet long and weighing about 1800 pounds, were clamped at intervals of 15 feet

About the Author

E. K. HARTZELL has been associated with various properties of Cities Service Company since 1923, including advertising, publicity and public relations capacities in Colorado, Ohio, Virginia and Tennessee. He joined Cities Service Gas Company in 1945 as assistant to the president.

across the stream bed and 50 feet apart in the approaches on each side. In addition, the river lines were protected against drifting or floating during floods by steel-band saddles fitted every 100 feet over the top of the pipe and bolted into screw-type anchors twisted deep into the ground at the bottom of the ditch.

Protection of the buried pipe from deterioration due to chemical conditions in the soil was provided by painting and wrapping. After the 40-foot sections were welded into a continuous line and supported along the trench on skids, a self-propelling cleaning and priming machine was placed on the pipe.

Traveling slowly along the pipe, wire brushes cleaned off all dirt and scale. A coat of primer paint was applied, and when the primer dried, a thick coating of hot tar enamel was applied over the primer coat by a traveling paint machine. This machine also wrapped the pipe spirally with heavy asbestos felt paper 18 inches in width and fed from 400-foot rolls. The completed coating was carefully inspected for breaks and holidays.

Extreme care was taken when the line was lowered into the trench to prevent any damage to the thick coating. When necessary, a cushion of soft dirt was spread so that the line would not lie on the hard surface.

Junctions of the two 20-inch river lines with the main 26-inch pipe line are the usual header type. Each header is a 20-foot section of 26-inch pipe laid at right angles to the larger main line and bullplugged at each end. The main 26-inch line was welded into one side of the header, and on the opposite side the two 20-inch crossing lines were connected. On each 20-inch line at the header a gate valve was installed so that each line could be shut off if necessary.

Provision was also made for temperature changes which vary the measured length of the lines by leaving slack loops which were lowered into the trench early in the day when temperatures were low.

Interior Cleaning

Interior cleaning of the completed line was accomplished by using a pipe line pig, fitted with metal scraper rings and wire brushes which press against the interior surface. With one end of the line open, the pig is forced through by gas pressure, and as it scrapes and brushes, it removes all particles of dirt, scale and foreign matter.

After this internal cleaning and further tests for defective material, the line was finally tested for gas transportation pressures up to 900 pounds per square inch. A final test for leakage was the shutin pressure drop method approved by the U. S. Bureau of Mines.

The total length of the 26-inch line will be approximately 400 miles and is being laid in two sections. The 182-mile stretch extending from southwestern Kansas to Hutchinson will have an estimated daily delivery capacity of 90 million cubic feet of gas daily when completed late in 1948. When the entire line is laid to Kansas City it is expected to deliver approximately 375 million cubic feet of additional gas daily.

One section of line will loop the present facilities between Ottawa, Kansas, and Kansas City for a distance of about 50 miles. The western section from the first compressor station near Ulysses, in Grant County, Kansas, will extend approximately 182 miles east and north to a connection with the existing system at Hutchinson.

Both are scheduled for completion by the early winter of 1948-49, if present pipe deliveries continue. The remaining gap between Hutchinson and Ottawa will be closed by completion of that section a year or so later, possibly by the winter of 1950-51.

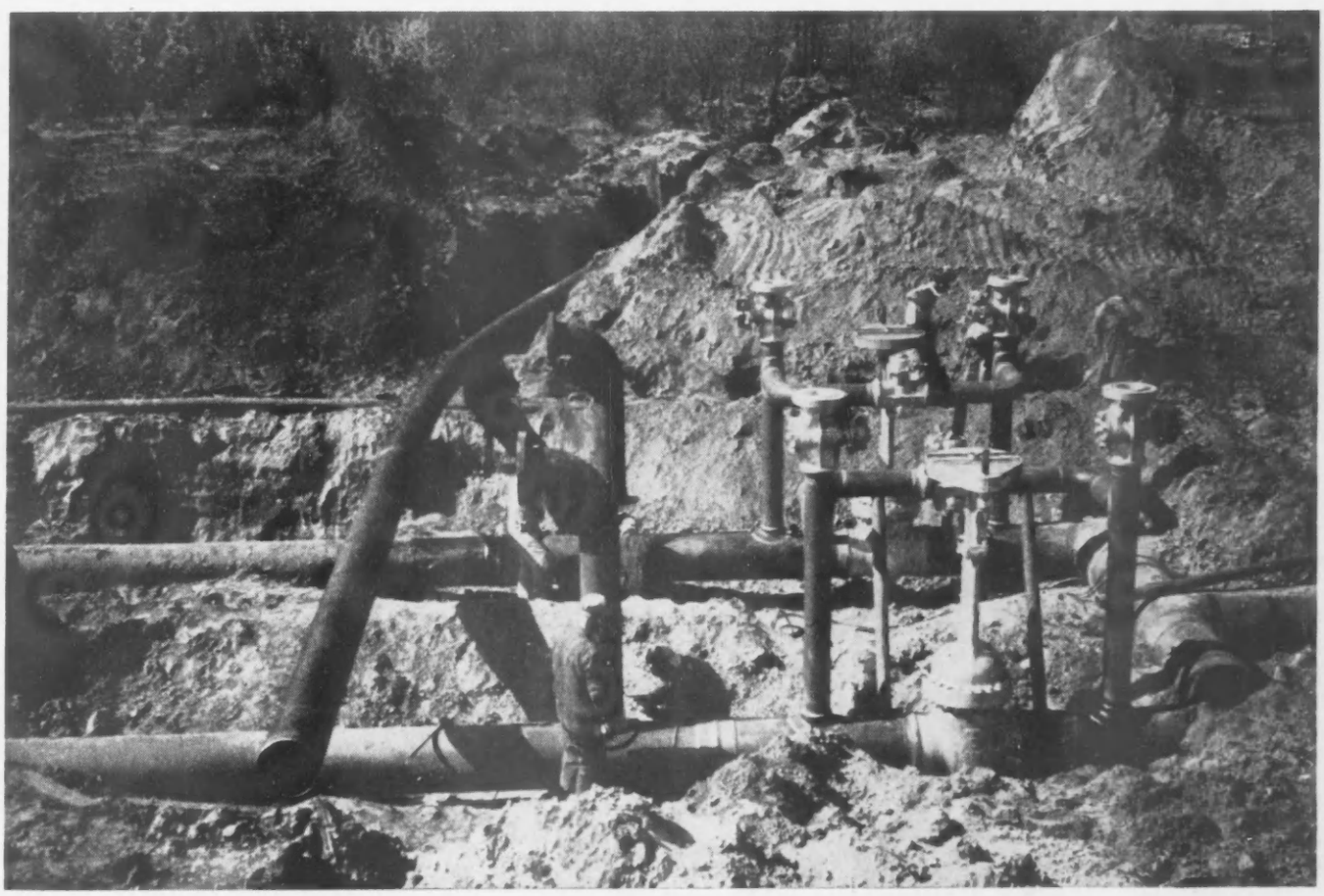
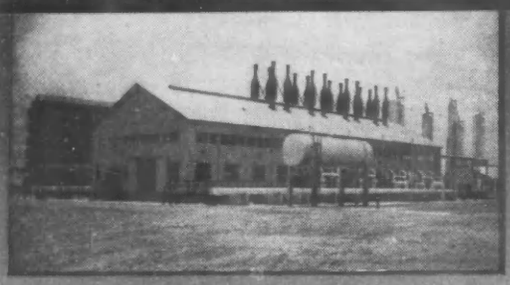
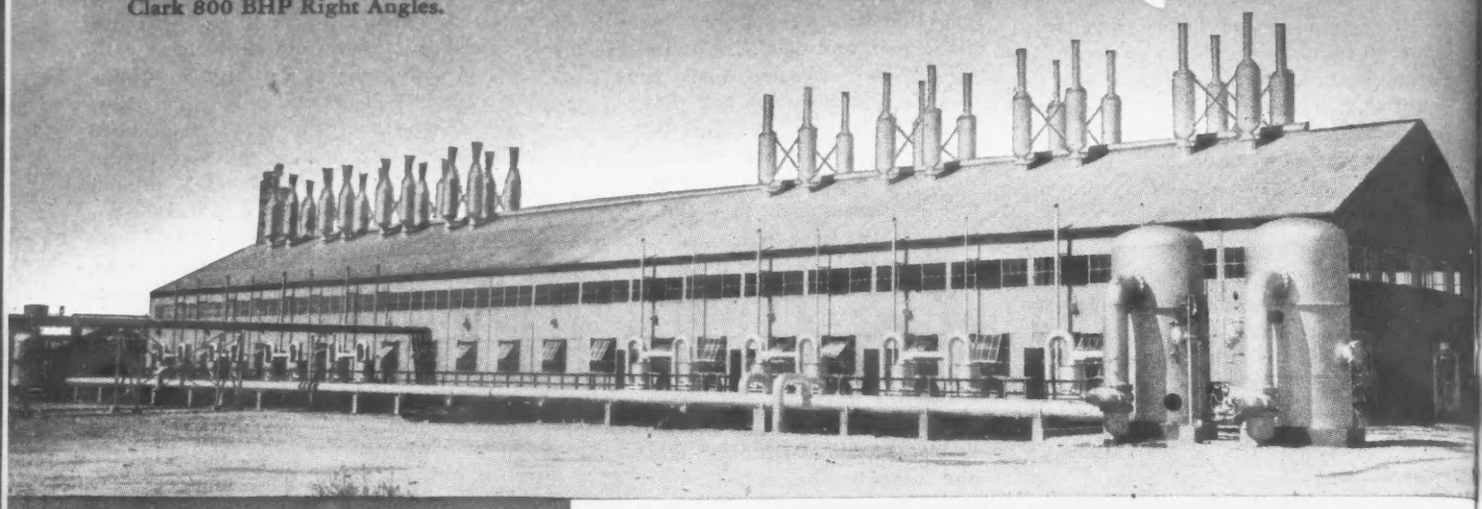


FIGURE 3.—Header about 1½ miles east of Arkansas River crossing. The 20-inch lines are 20 feet apart at the header. The 20-inch main line gate valves with 8-inch bypass and blowoff gates are shown in the right foreground. Welder is installing connection for 16-inch which extends north to Hutchinson station site to tie into present lines.

Shell Repeats

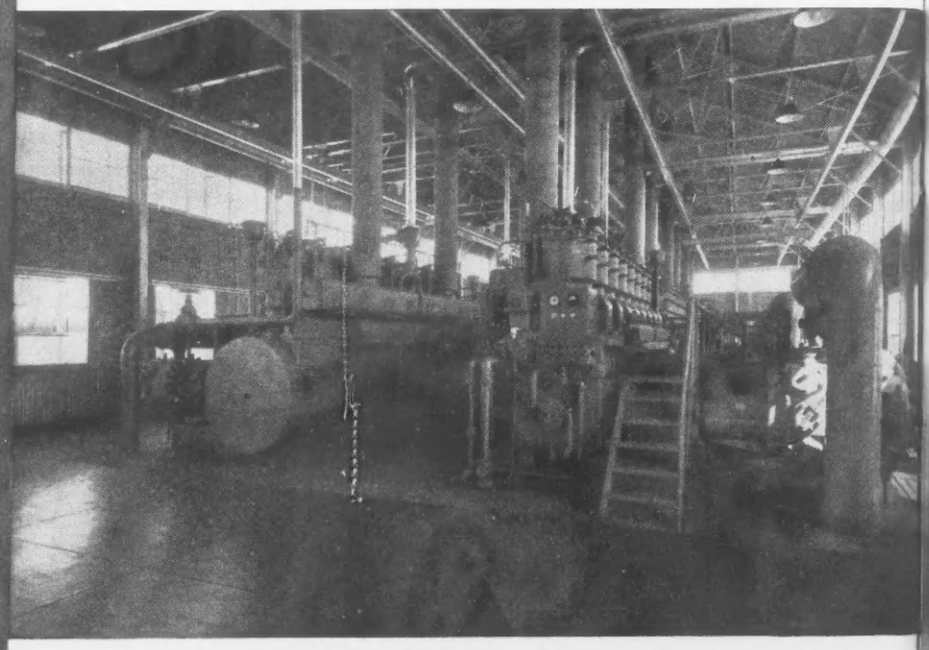


Original compressor installation at Wasson No. 2 Plant consisted of eight Clark 800 BHP Right Angles.

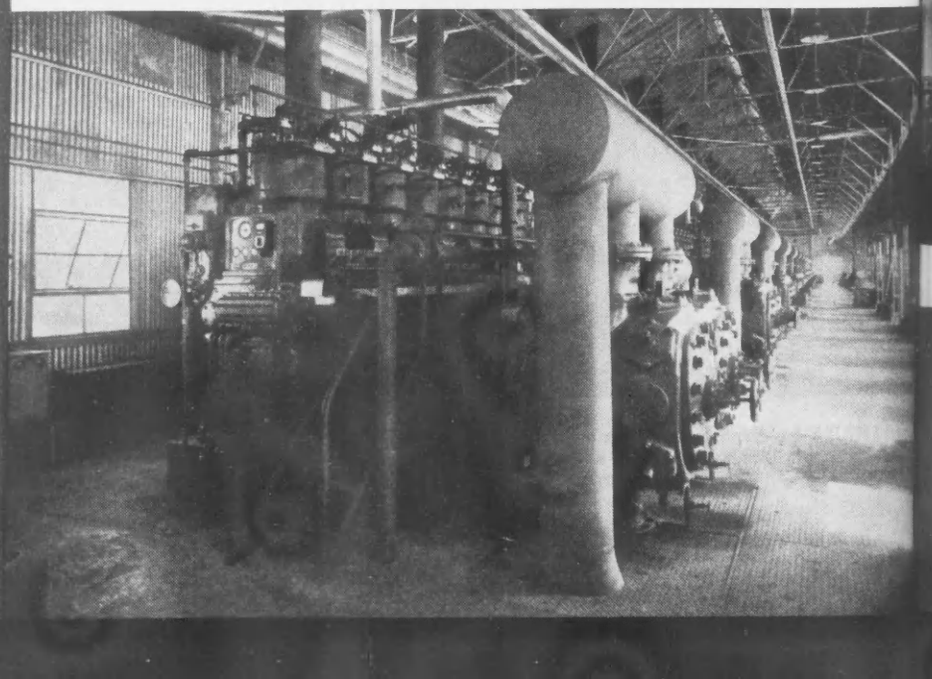


Wasson No. 2 Plant was expanded and eight more Clark Compressors were added.

This photo shows one of the two similar installations of Clark Right Angles at Wasson No. 2 Plant.



Eleven Clark units are visible in this interior view of the T.X.I. Plant.



with Clark Compressors

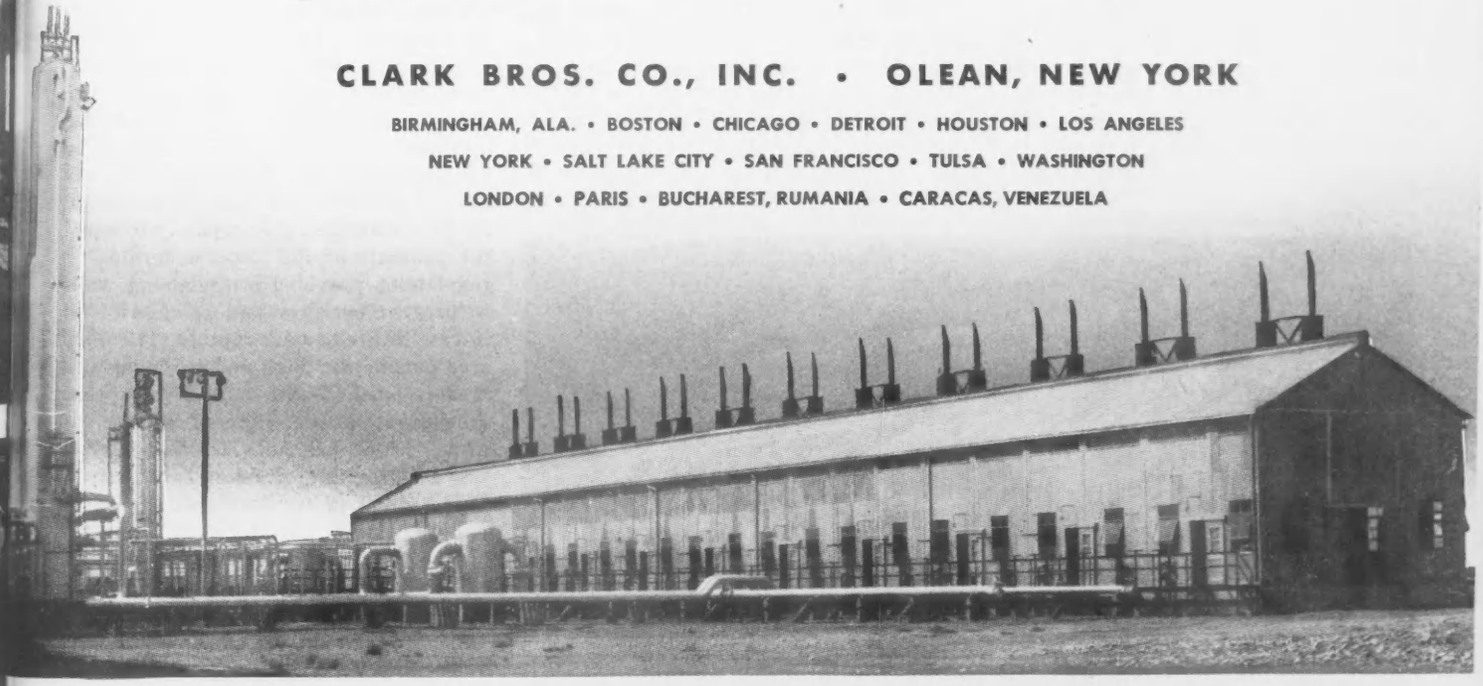
for New TXL and WASSON No. 2 Gasoline Absorption Plants

The Shell Oil Company's new TXL plant in Ector County, Texas, duplicates the operating conditions of Shell's Wasson No. 1 and No. 2 gasoline absorption plants in Yoakum County, Texas.

In these modern plants, 34,400 brake horsepower of Clark Right Angle Gas Engine Driven Compressors take the gas in from the field at pressures between atmosphere and 7 psig and compress it in two stages to a final discharge pressure of 205 psig. At this final pressure, the hydrocarbon gas is processed in highly efficient absorber units where the gasoline is extracted.

CLARK BROS. CO., INC. • OLEAN, NEW YORK

BIRMINGHAM, ALA. • BOSTON • CHICAGO • DETROIT • HOUSTON • LOS ANGELES
NEW YORK • SALT LAKE CITY • SAN FRANCISCO • TULSA • WASHINGTON
LONDON • PARIS • BUCHAREST, RUMANIA • CARACAS, VENEZUELA



Shell's new TXL Plant in Ector County, Texas, showing compressor house in foreground containing eleven 800 BHP Right Ang

CLARK

ONE OF THE DRESSER INDUSTRIES

SETS THE PACE IN COMPRESSOR PROGRESS

Building Permanent Tank Dikes

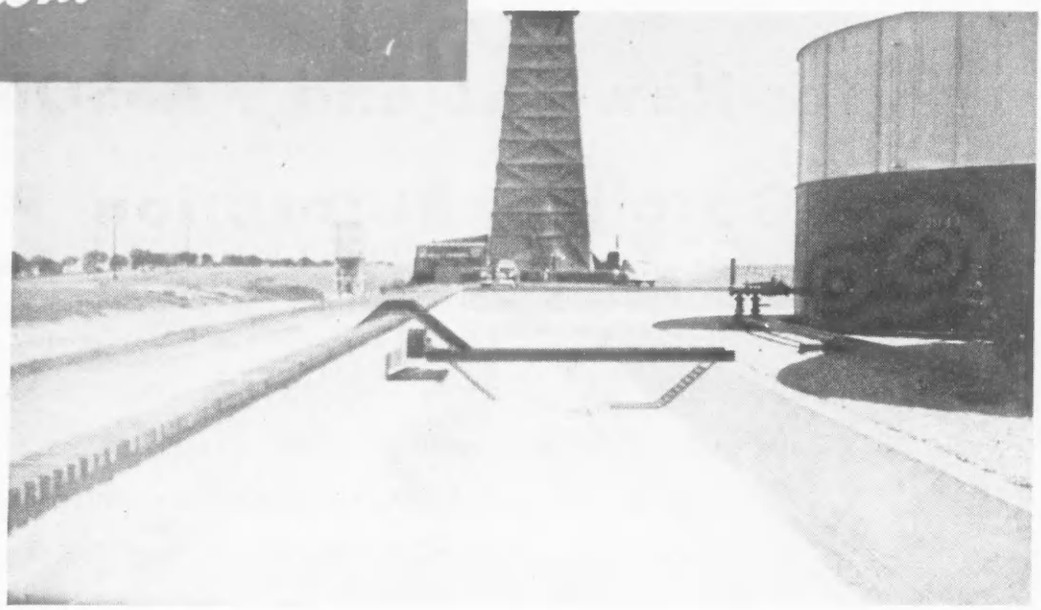


FIGURE 1—This concrete-lined firewall provides quick runoff for small quantities of fluid through small inner ditch, while total volume provided by flume will care for entire contents of tank within the enclosure. The brick-topped concrete block wall provides additional impounding area, with access to the tanks through removable bridge and steel stairway.

DIKES which surround individual units in a tank farm are commonly constructed by excavating the top soil from the entire area around the tank. This practice fully met regulations concerning safety and conservation. Such common earthern dikes require constant maintenance to repair incipient breaks due to weathering and a considerable amount of hand labor to keep down growth of grass and weeds. Frequent spraying with oil is needed to preserve the surface. To eliminate much of this type of maintenance and at the same time add to the attractiveness of the premises, Continental Oil Company recently developed a tank setting involving the use of an entirely different pattern of tank dikes. This type of dike is particularly applicable to all areas in producing zones near public buildings and in residential sections where property values are to be maintained.

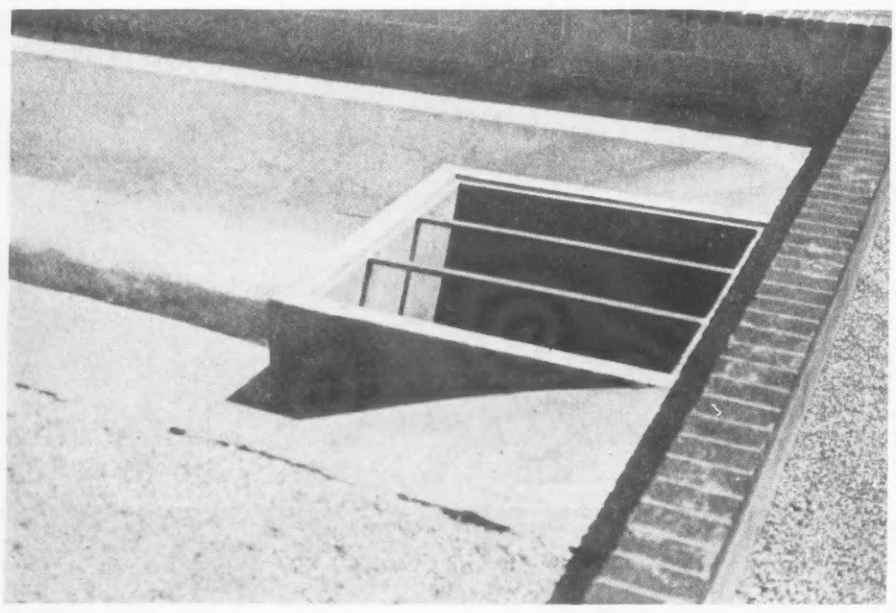


FIGURE 2—One corner of the firewall, showing small ditch as well as barred pit giving access to outlet for full flow of fluids from area. The sump, set below the level of the ditch walls, provides for gravity separation of oil and water where desired.

The plot of ground selected as a site for the tanks, oil and gas separators, and oil heaters is graded higher than surrounding land by excavating a continuous ditch on all sides of the tank foundation location and spreading the material over the area both inside and outside the dike so that adequate drainage will be provided during the rainy season. The ditches from which the material is excavated are cut with straight lines and are calculated in cubic capacity to equal the contents of the tanks according to regulations provided for retaining walls to prevent overflow and spillage of oil in case of fire or tank rupture. The filled area outside the ditch and retaining wall area is finished with a layer of spread crushed stone, decomposed granite, or gravel which has sufficient thickness to prevent growth of grass and weeds.

The ditch proper is constructed as a wide canal with an inner narrow channel running the entire length to speed flow of small quantities of liquids to a sump at the terminus. The sides of the ditch slope inward from the shoulders on both sides at an angle of approximately 45 degrees to the flat bottom in which the narrow channel is placed. All shoulders, sides, floors, and the narrow channel are covered with float-finished concrete.

Outside the ditch and on all four sides of the tank setting is the emergency retaining wall made of vitrified building tile set in mortar and capped with paving bricks.

Engine Overhaul Dynamometer Laboratory

By W. D. OWSLEY
Technical Adviser, Halliburton Oil Well Cementing Company

THE use of dynamometers for engine testing and for run-in of engines after overhaul has long been recognized as a desirable procedure by engine builders and large fleet owners. The Halliburton Oil Well Cementing Company maintains a complete dynamometer laboratory at the Duncan plant. The dynamometer room is equipped with two 300 horsepower induction dynamometers and one hydraulic dynamometer. All units are set up with individual instrument panels for the obtaining of complete information on the engine being tested.

The instrumentation includes precision tachometers, pyrometers for exhaust and oil temperatures, water temperature, air box pressure, crankcase pressure, oil pressure, fuel pressure, ammeters, and start, stop, emergency stop, and speed control units. The laboratory is equipped with overhead monorail hoists for speedy handling of the engines. The dynamometer stalls are adjustable to take care of the many types of engines used by the company. A complete line of bell housing adapters is maintained for connection of the engine to the dynamometer on which it is placed.

A separate cooling system with water tanks, pumps, and cooling tower is located outside of the building for supplying cooling water to the engines on test and to the dynamometers. All piping for fuel, either gasoline or diesel, electrical connections, and exhaust connections are located in conduit trenches under the floor of the laboratory. It is possible to set the average engine on to the dynamometer and have it running for any desired test in about 20 minutes.

All of the company engines, after rebuilding in the engine shop, are sent to the dynamometer laboratory for a complete run-in test and run-in procedure as set up by engineering specifications for each engine being handled. Each engine is equipped with a brass name plate which gives the date of rebuild and the order number on which the rebuild was conducted, also the inspection mark of the dynamometer room supervisor certifying that the engine is satisfactory and has passed all dynamometer room tests to meet specifications.

The dynamometer laboratory is also frequently used to check new engines and to conduct test procedures on various accessories, fuels and methods of maintenance.

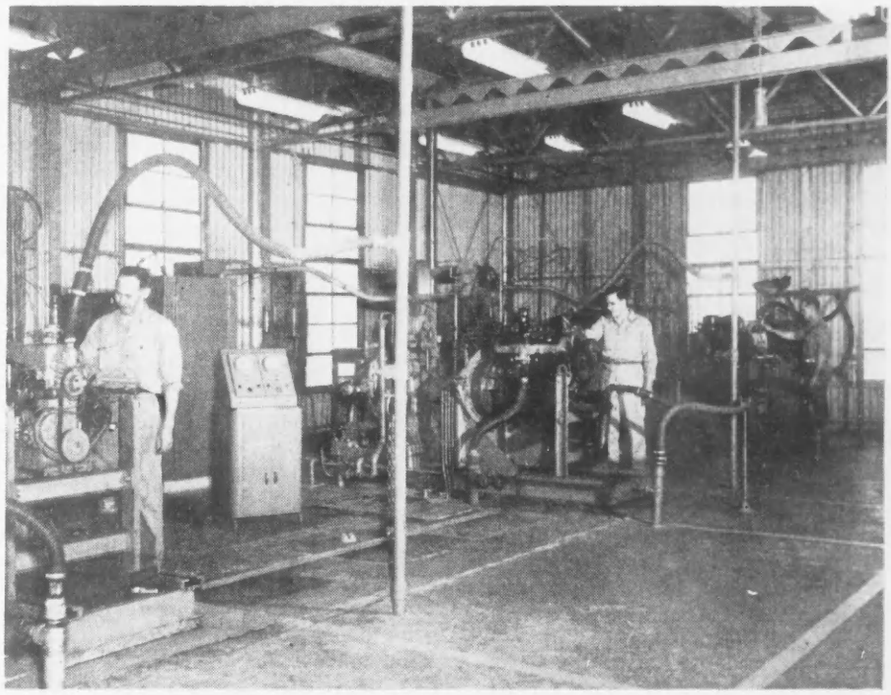


FIGURE 1.—Each stall for engine test is equipped with flexible hose connections for cooling water, as well as for tying exhaust to underground main. Special stands support the units under test, with arrangements for leveling and positioning to center with dynamometer bell housings.

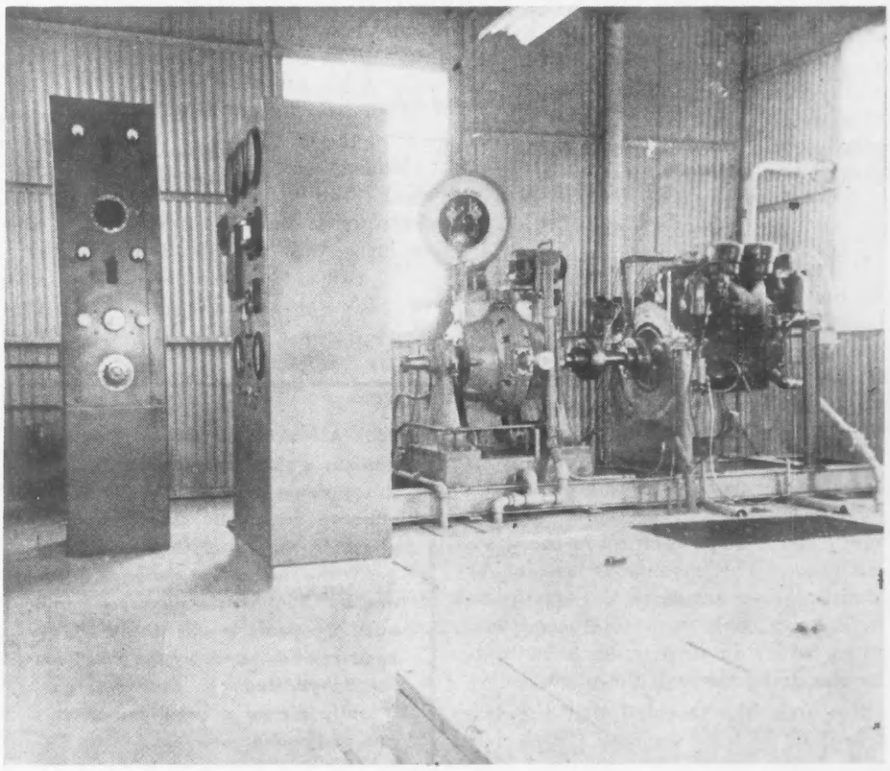


FIGURE 2.—One of the test units, with accompanying control panel whereon any given load conditions can be adjusted to prove engine under test.

Basic Problems

In Gas Dehydration

By J. I. MORRIS

THE dehydration of natural gas has passed from the status of an art to that of an exact science. The principal reasons for this assertion may be cited as follow:

1. More exact information on the effects of increased line pressure with respect to the formation of hydrate in natural gas transmission lines.
2. The demand for continually higher line pressures on gas transmission lines.
3. The downward trend in dehydration costs as the result of technical research and development in dehydration processes and equipment.
4. An increased demand for uninterrupted service from high pressure gas transmission lines.

The gas hydrate consists of the hydrocarbon molecule combined with six or seven molecules of water. These hydrates are unstable and under favorable conditions of pressure and temperature decompose to form gas and water. Hydrate compounds are inflammable and closely resemble ice or snow, depending entirely on the conditions in which they are formed. Regions of turbulence create hydrates resembling snow; these are more prevalent. Gas hydrates are cumulative and once started proceed to form at a rapid rate.

Formation of Hydrates

It has been proved that if it were not for the water present in the gas, hydrates as such could not form; therefore, the sources of water in the gas should be investigated. In the gas-bearing sand there is generally contact between the gas and the aquafier so that the gas in the sand is saturated with water vapor at the existing conditions of temperature and pressure. Another source is the absorption oil in the gasoline plants. The gasoline is distilled by admitting free steam to the fractionating column. This saturates the oil with water, which in turn tends to saturate the gas going through the plant.

Research has revealed that the tendency for hydrate formation varies directly with the applied pressure. The effect of an increase in pressure is to increase the temperature at which gas hydrates will form and freeze-up the line. Specifically, gas lines should give negligible trouble due to hydrate stoppage as long as the pressure on the line is approximately 100 pounds per square inch and as long as the pipe line is buried below the frost line.

Knowing the causes and results of hydrate formation in natural gas lines, the question confronting the engineer is how to alleviate and possibly prevent hydrate formation. Every pipe line will present its own peculiar problems but primarily the engineer should satisfy himself on the following points since they are general in all dehydration problems:

1. What is the minimum gas temperature that will be encountered at operating pressure below which the gas dew point must be maintained?
2. What effect will a decrease in temperature below the dew point of the gas have on the line? Would this tend merely to drop out water in the line or would it result in the formation of hydrates resulting in a freeze-up?
3. What is the water content of the gas entering the system?
4. What are the turbulent characteristics of the line?

Having ascertained the factors influencing the formation of hydrates and determining how to prevent them, the engineer must consider the most practical, efficient and economic methods whereby the condition may be overcome.

INCREASING DEMANDS for natural gas has emphasized the handling of this product from the well to the ultimate consumer. One important phase in the processing of natural gas is the removal of water or dehydration. The article discusses some basic problems in this phase which, because of demands by the pipe lines for dehydrated gas over wet gas, actually places a premium on this gas and makes dehydration an important consideration to the operator and field man.

Although there are many methods of removing water from and/or inhibiting formation of hydrates in natural gas, the principal methods may be classified under the following five major operations: (a) installation of drips; (b) reduction in line pressure; (c) direct or indirect heating of the gas line; (d) placing lubricating chemicals in the gas line; and (e) partial dehydration or dehumidification.

So that the field man may acquire a better understanding of these measures, each will be briefly described and uses, advantages, and limitations will be pointed out.

Installation of Drips

This method for combatting dehydration was one of the earliest adopted by the gas industry as it was recognized that line freeze-ups resulted through the accumulation and freezing of water in the transmission lines. Drips were installed on the theory that gas must be cooled so that the water vapor in the line could condense. In theory the gas was expected to expand and cool when it passed through the drip and the condensed moisture was to be collected in a metal sump and discharged or emptied. Drips, although contributing somewhat to solve the condition, were at best inefficient and proved impractical in lines operating under high pressures. However, drips are still commonly used in field lines with pressures below 500 psi, in special cases in highly saturated gas wells producing in exceptionally cold climates, and in installations where liquid accumulates between wells and other points. Conditions should be studied carefully by the field man contemplating the use of drips in combatting dehydration.

In the case of wells producing a high percentage of condensate it is customary to install separators, but drips also may be used and they are then located near the well-head. Gas is allowed to pass through two large drip installations which are buried below the surface where it cools and condenses water vapor. After the gas passes through the second drip a certain amount of water vapor

Out of these spinning wheels comes quite a yarn!

THERE'S A REAL STORY being spun on the thousands of miles of roads that connect thousands of refineries, bulk stations and filling stations.

One of the chapters goes like this:

A company learns its "pipelines on wheels" operate more efficiently when trucks are specialized for the job. They get the right truck for oil transport from International's 22 basic models, 1,000 different truck combinations, gross weight ratings from 4,400 to 90,000 pounds. Happy ending.

Another chapter goes like this:

A company learns it saves time and money when there's a real truck service set-up to turn to for maintenance requirements. They learn that because they have Internationals . . . and International offers the nation's largest exclusive truck service organization. Happy ending.

There are other chapters on rugged stamina, on low-cost operation, on all the factors that go into modern, efficient trucking of oil from field to user. The best way to get the part of the story you're most interested in is to see your nearest International Dealer or Branch. You'll save by doing that *soon!*

Tune in James Melton and "Harvest of Stars," CBS, Wednesday evenings

INTERNATIONAL TRUCKS

MOTOR TRUCK DIVISION · INTERNATIONAL HARVESTER COMPANY · CHICAGO

generally is present but not sufficient to cause a freeze-up of the line.

As additional protection where condensation is likely to occur along the line, drips are placed at regular intervals throughout the system. Accumulated water is blown out by hand or by means of a semi-automatic device called a stinger, which is activated by gas pressure in the drips. A stinger consists of two pipe lengths one inch and one-half inch in diameter. The smaller diameter pipe is fitted inside the larger which is screwed into the line. A valve is installed atop the smaller pipe and when opened, the water is expelled by pressure in the system.

Reduction in Line Pressure

Reducing line pressure in order to overcome hydrate formation is to employ the principle which postulates that by reducing pressure in the line a lowering of temperature is achieved, thus reducing hydrate formation. Unfortunately, this method is limited in its application and is very infrequently used, as it can be employed only in areas operating under extremely high pressure and only a very small temperature range.

Direct or indirect heating of the gas line has found application in the gas industry in field installations and in systems which are not equipped with a central dehydration plant.

This method has the disadvantage of making it difficult to locate the heating unit at a point where it may be installed permanently since it must be moved with varying conditions and this entails additional labor and maintenance costs.

Gas lines are heated by direct flame, indirectly by the use of water as the heating medium, and as a result of gas compression.

Heating the line by direct flame has obvious disadvantages since an open flame near a gas line presents an extremely bad fire hazard. Although this method has proved very effective in preventing the formation of gas hydrates the hazard involved is too great and therefore is seldom used. Additional personnel must be employed in order to guard against fire as well as to apply heat along the line.

On the other hand, the application of indirect heat is more extensive. It practically eliminates the fire hazard presented by direct heating and gives satisfactory results in preventing hydrate formation, although it must be pointed out that its effectiveness is more pronounced over relatively short distances of line or where superheating of gas condensate is desirable.

Indirect heating consists of passing the gas through a metal container filled with water which resembles an oil field boiler. The water is heated by a closed heater burning gas as fuel. Heaters on the market are between 10 and 12 feet long and from three to six feet in diameter. Gas is taken direct from the well-head and passes through parallel lines to the heater, thence into the main transmission line.

Prevention of hydrate formation by lubricating or placing inhibitors in the line attracted the attention of engineers in the early stages of the problem. The results were only partially satisfactory. One inhibitor, ammonia, reacted chemically with impurities in the gas with results that proved more harmful than the gas hydrates themselves. As the recovery of the inhibitors is negligible the cost involved is excessively high. Inhibitors also meet the same difficulty in being properly placed as do the heaters. Principal hydrate inhibitors in use include crude oil, methyl alcohol, anhydrous ammonia, and calcium chloride brine.

Partial Dehydration Method

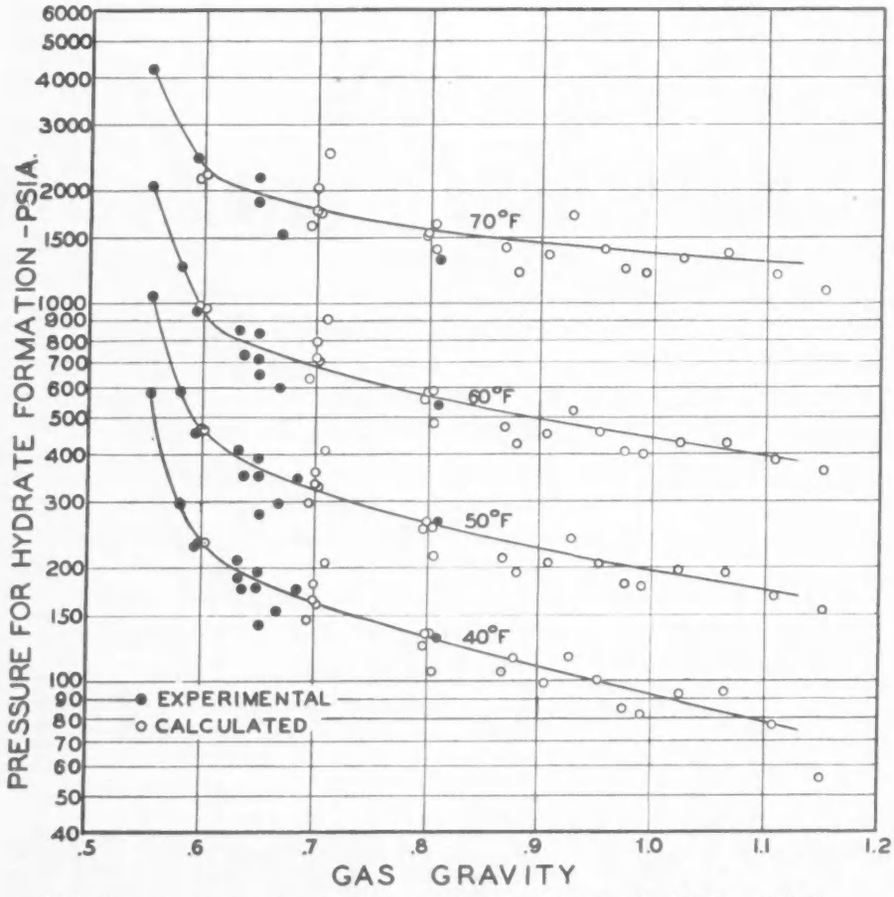
The newest and most widely used method for preventing hydrate formation is that of partial dehydration or dehumidification. This method is being continually improved both from an operating and economic standpoint.

There are several types of dehydration plants including plants using solid desiccants for adsorption of water vapor from the gas; plants using concentrated solution of inorganic brines to absorb water vapor from the gas; plants using liquid organic chemicals to absorb water vapor from the gas; and plants using refrigeration, or compression and refrigeration, to obtain condensation of water vapor followed by removal of water from the gas stream.

Although its advantages in the prevention of gas hydrates are well established and its use is primarily for this purpose, dehydration may also be undertaken as a means to combat corrosion, as is the case in California and other areas.

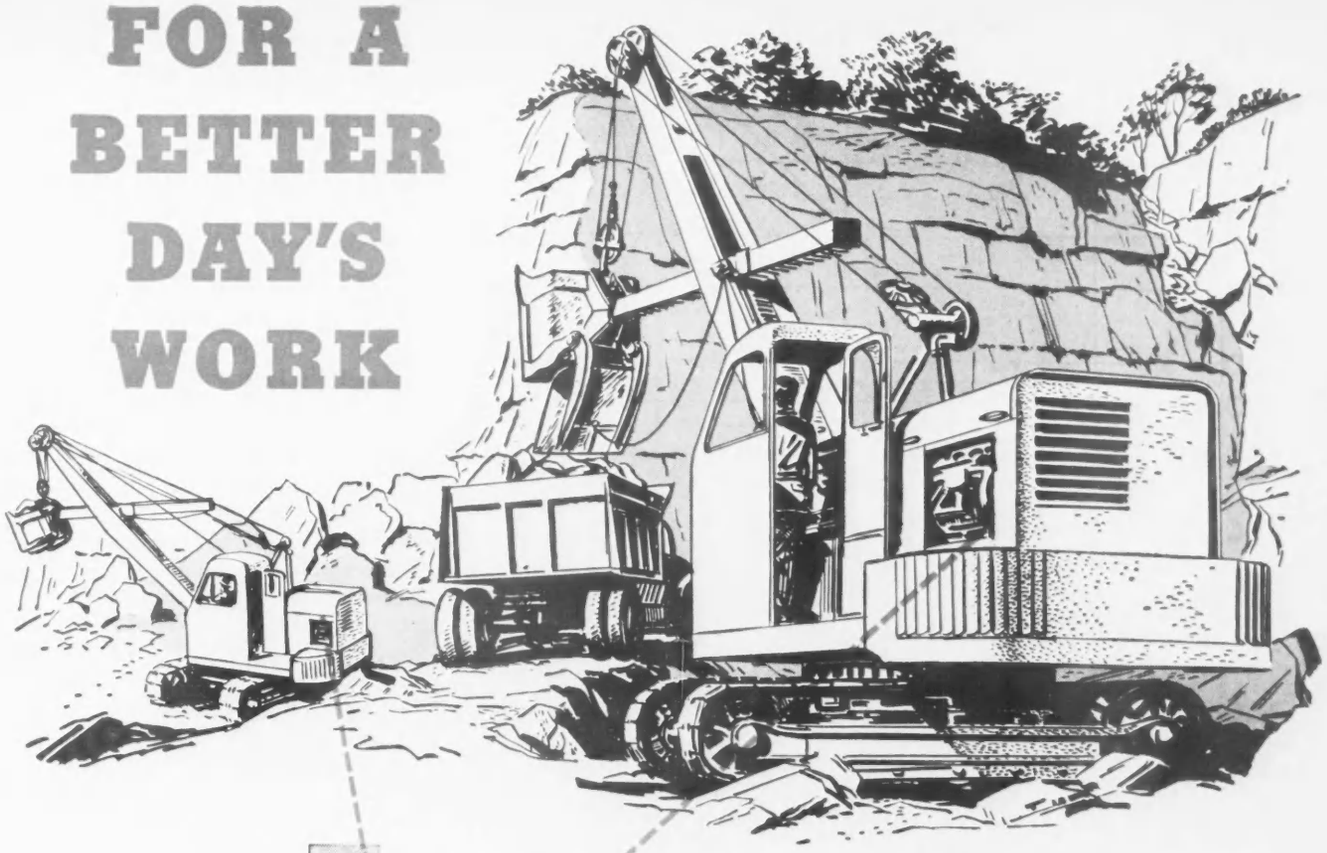
Dehydration has become an established technique in the handling of natural gas under high pressure and affords increased line capacity, reduces shutdowns resulting from leaks and ruptured lines, eliminates the use of drips, and prevents or mitigates internal corrosion of lines and equipment.

Dehydration plants using solid materials for the adsorption of water vapor from the gas, such as bauxite, alumina and other chemicals, have the advantage of accomplishing a degree of drying far beyond other methods of dehydration, particularly at pressures in excess of 500 psi, provided the adsorbent material is worked at reasonably low saturation points. In the case of calcium chloride brine plants, many of which are now in use, results are most effective when the brine is cooled by a refrigerating agent.

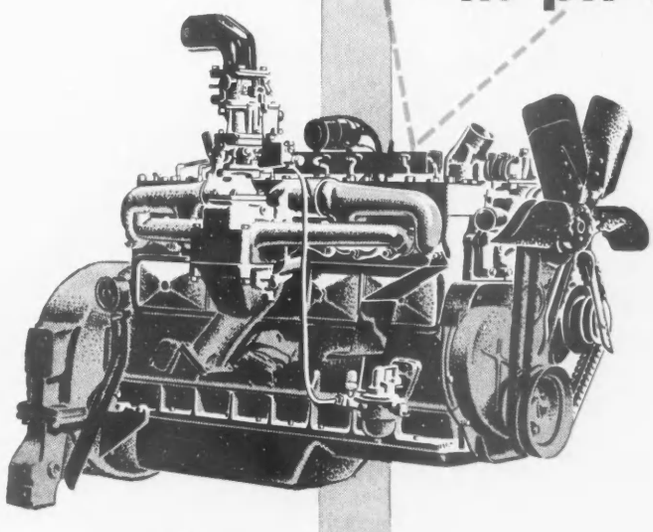


Hydrate pressure-temperature relations as a function of gas gravity. (Dr. Donald F. Katz, Technical Paper No. 1748, AIMME.)

FOR A BETTER DAY'S WORK



in pit and quarry operations



● **Where digging is tough and tricky . . . where steady, dependable power is the difference between profit and loss . . . you'll find Chrysler Industrial Engines and Power Units on the job! Chrysler Industrial Engines provide power *for a better day's work* on cranes, shovels, pumps, cableways, conveyors, drills, crushers and in other mining or quarrying equipment. For economical power that's tailored to *every* industrial application, see the Chrysler Industrial Engine dealer near you; for detailed data and specifications, write . . .**

INDUSTRIAL ENGINE DIVISION, CHRYSLER CORP.
12200 E. JEFFERSON, DETROIT 31, MICHIGAN

Serving America

IN INDUSTRY—ON FARMS—IN FORESTS—IN OIL FIELDS AND ON THE HIGHWAYS!

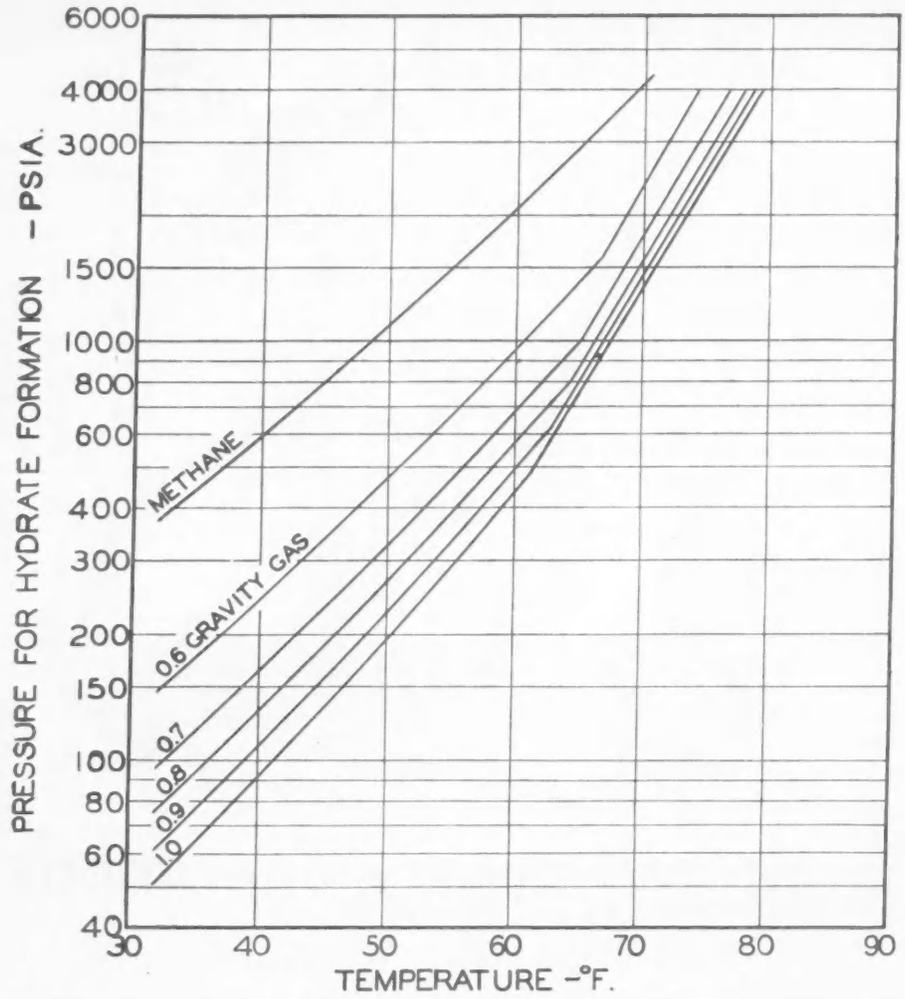
NATION-WIDE SERVICE

FACTORY-ENGINEERED AND TESTED PARTS WITH EXPERT MAINTENANCE WHEREVER YOU ARE

CHRYSLER

INDUSTRIAL ENGINES AND POWER UNITS

HORSEPOWER WITH A PEDIGREE



Minimum temperatures at corresponding pressures at which a given gas may be cooled by expansion, or otherwise, without hydrate formation. (Dr. Donald F. Katz, Technical Paper No. 1748, AIMME.)

Plants employing organic chemical solutions to absorb water vapor from the gas are used most extensively where extremely low dew point depressions are not necessary and where pressures do not exceed 500 psi. The primary dehydrating agent used is diethylene glycol. It has also found application in individual well-head dehydration plants.

Where refrigeration or compression and refrigeration are used to obtain water vapor condensation followed by removal of the water from the gas system, the mediums used are propane, butane, cooled brine, and water. As the compression method is dependent upon a reduction of volume it is limited to low pressure gas and even then results are not entirely satisfactory.

Table 1

Effective Cooling Range of Dehydration Processes

(Based on dehydration of natural gas at 500 psi and 70° F.)

AGENT	Dew Point Depression	Resultant Temperature
Refrigeration	14° F.	56° F.
Calcium Chloride	30° F.	40° F.
Diethylene Glycol	50° F.	20° F.
Activated Alumina	140° F.	—70° F.

Factors Involving Type of Plant

The selection of the most suitable type of dehydration plant for any particular problem or situation must be guided by a careful study of conditions. Selection should be based on a careful and complete survey of all pertinent factors. The dew point depression that must be obtained is the most important single factor. Plant location and operating pressure are important factors which must be considered, and there is also the question as to whether one large plant or many small well-head installations will prove most effective and economical. The single plant is less expensive but does not afford adequate protection when the gas passes from the wells to the main lines which, due to the high pressures under which they operate, are more subject to hydrate formation.

The cost item naturally plays a major part in the final selection of the method to be used. The overall cost of operation is governed by factors which vary with each particular plant such as load factor, operating pressure, inlet temperature, outlet temperature, outlet dew points, utility costs and location on the system.

Different type plants in order of ascending operating costs of dehydration per million cubic feet of gas are plants using refrigeration; plants using inorganic brines; plants using solid adsorbents (although this method may be cheaper for large volumes and high pressures); and plants using liquid organic chemicals.

Although most types of dehydration plants have a basic operating cycle and consist of similar units, each is designed for a given set of conditions. The operator should bear this in mind when he is considering an installation and should give careful study to all the conditions so that he may select the type plant which will overcome his own particular problems and assure efficiency and economy in operation.

TABLE 2

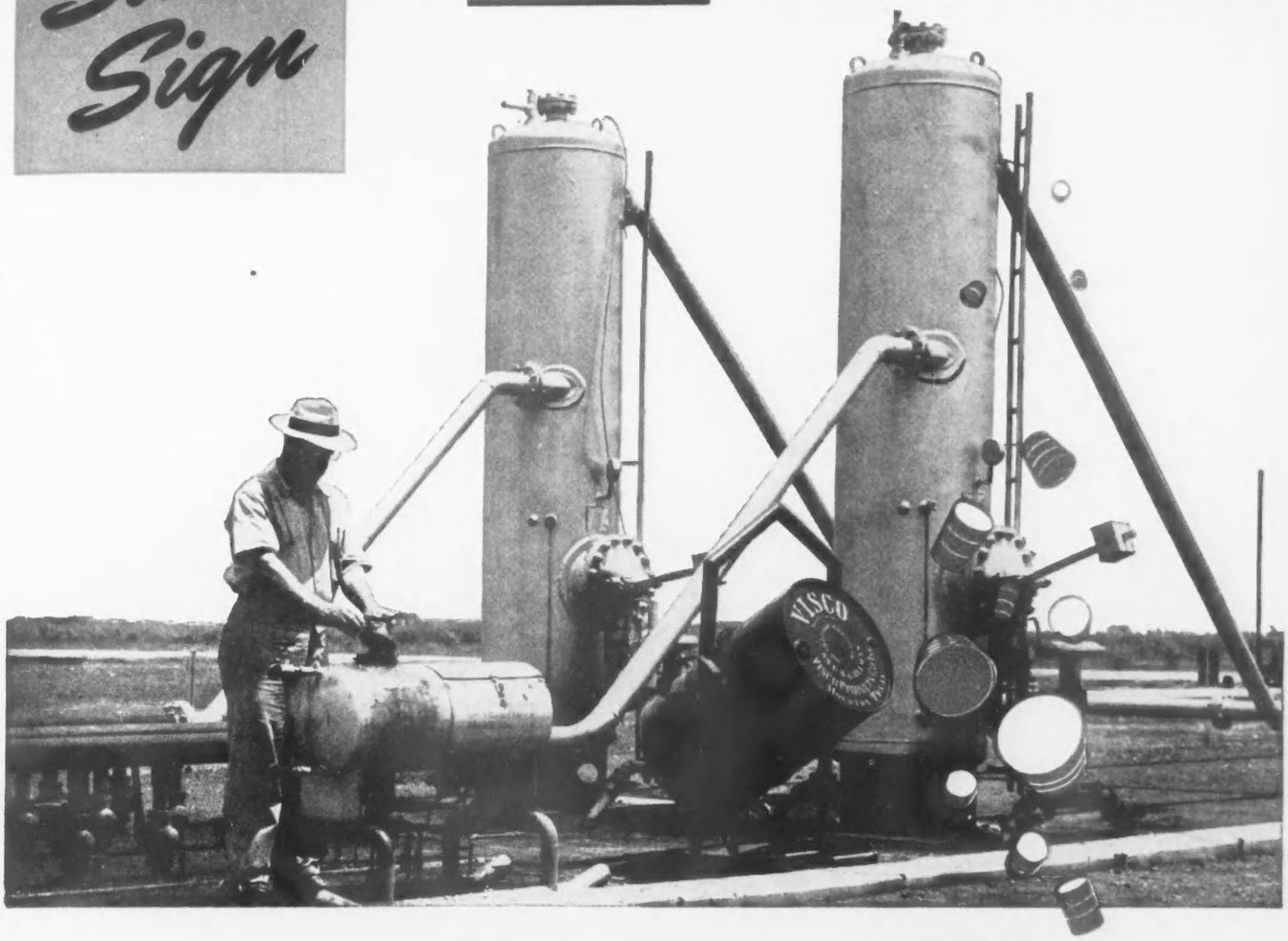
Dehydrating Plants and Known Operating Data

LOCATION	Dehydrating Agent	Line Pressure Psi.	Plant Pressure Psi.	Plant Inlet Temperature °F.	Dew Point Depression °F.	Volume of Gas per Day MCF	Resultant Line Pressure Psi.	Cost of Plant	Cost of Dehydration per Day per MCF of Gas
1. The Southern Natural Gas Company	Activated Alumina	1,200	1,200	80	12	48,000,000	1,200		
2. Oklahoma Natural Gas Company	Activated Alumina	1,800	1,800	78	90	60,000,000	1,800		$0.034
3. Mesa Grande	Silica Gel		353	95	23	8,827,500			0.042
4. Tennessee Gas Transmission Company	Diethylene Glycol		840	80	50	300,000,000			
5. Pacific Lighting Corporation	Diethylene Glycol	1,050	1,025	78	40	150,000,000	1,000		
6. Panhandle-Eastern Pipe Line Company	Diethylene Glycol								
7.	Diethylene Glycol		300	90	42				0.0436
8.	Diethylene Glycol		500	76	38				0.0285
9. Continental Oil Company	Diethylene Glycol	1,800	40	85	45	12,000,000			
10.	Calcium Chloride	700	500			73,000,000			
11.	Diethylene Glycol		400						

NOTE:—Information for the blanks which have not been filled in has not been released for publication

Sure Sign

OF EFFICIENT EMULSION-BREAKING



Best sales story for Visco is direct comparison ...You can prove Visco Emulsion-Breaking speed, efficiency and economy right on your own lease. Ask your Visco Representative for cost-saving action on your emulsion breakers, now.

VISCO PRODUCTS COMPANY
INCORPORATED
City National Bank Building
Houston 1, Texas

Visco

DEHYDRATING AND DESALTING CHEMICALS • WHEREVER COST AND EFFICIENCY COUNT

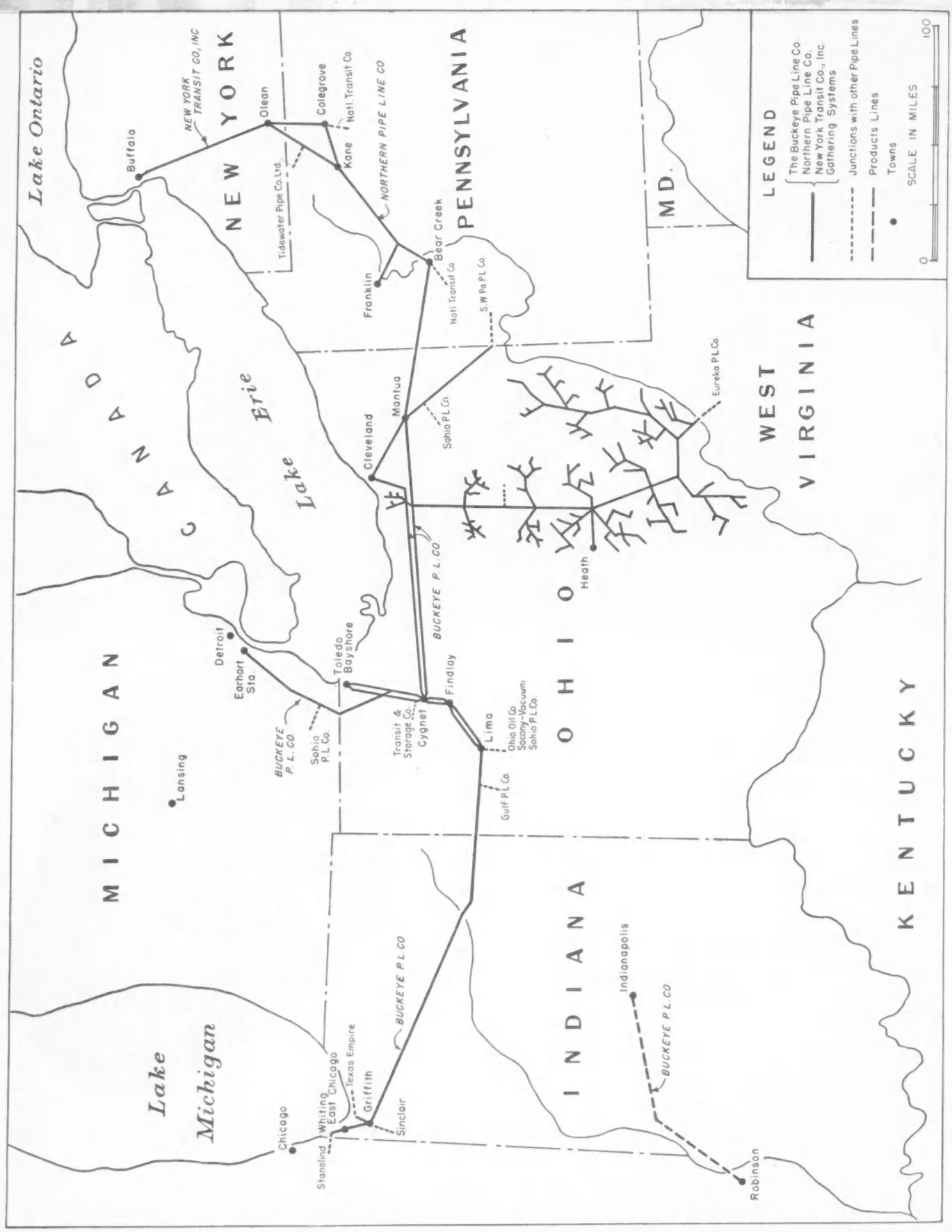
NOTICE: Visco Products Company is authorized to manufacture and sell Visco Oil Treating compounds for use in the breaking and resolving of oil emulsions, and to grant licenses for such use, under the following United States patents: 1,860,662; 1,860,663; 1,912,330; 1,937,559; 2,050,639; 2,050,640; 2,206,589; 2,214,782; 2,214,784; 2,225,189; 2,303,414; 2,307,853; 2,318,036; 2,318,036; 2,321,056; 2,335,954; Re. 20,749 and patents pending. Any purchaser of Visco Oil Treating compounds is authorized to use the same in the treating, breaking and resolving of oil emulsions in accordance with the above patents. The royalty for such use is included in the purchase price. Visco Products Company is authorized to and is willing to grant licenses on a royalty basis, to all companies, and to others desiring to practice the patented subject matter, under any and all of the above patents, permitting the user to purchase the oil treating compounds at will from any vendor, and to prepare the compounds for use under the above patent or patents, at a royalty charge of 20 cents per gallon. Application for license should be made to **Visco Products Company**, Houston, Texas

Pipe Lines of the U.S.

Buckeye Pipe Line Company

AND AFFILIATED COMPANIES

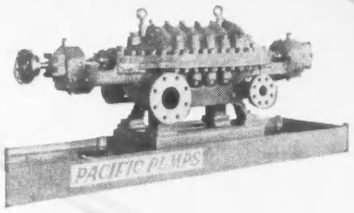
57th of a Series



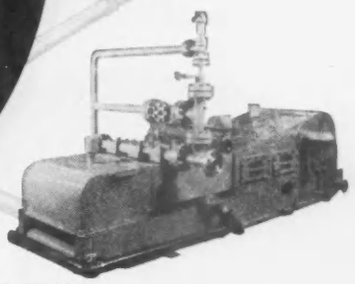
EVERYTHING FOR A PIPELINE

BUT THE PIPE ITSELF

DRESSER MFG. DIV.
—COUPLINGS

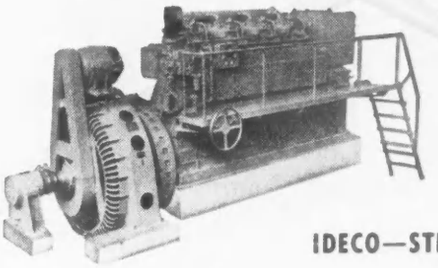


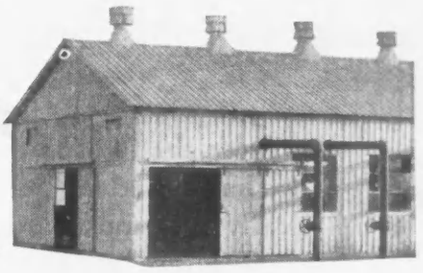
PACIFIC—MULTI-STAGE CENTRIFUGAL PUMPS



CLARK—RECIPROCATING PUMPS

CLARK—DIESEL ENGINES





IDECO—STEEL BUILDINGS

But what's that to you?

This—Dresser over-all coverage of the oil industry, from well to refinery, provides you with matched equipment. And engineering advice that covers the job—not just one piece of equipment. Dresser engineers in one company are available for consultation with all other Dresser companies. You can get unprejudiced advice about alternate types of equipment.

Dresser Industries does not need to compromise engineering for the sake of a sale.

For example, you can get either reciprocating or centrifugal pumps for a pipeline. Pacific-type centrifugals or Clark-type reciprocating. Above all, you get an over-all balance of equipment throughout the job. Dresser Industries furnishes equipment that is right, without grinding an ax for type.

DRESSER INDUSTRIES, INC.

TERMINAL TOWER • CLEVELAND 13, OHIO

Matched Equipment Matchless Service

BOVAIRD & SEYFANG Mfg. Co.
Bradford, Pa.

BRYANT Heater Company
Cleveland, Ohio; Tyler, Texas

CLARK Bros. Co., Inc.
Olean, New York

DAY & NIGHT Mfg. Co.
Monrovia, Calif.

DRESSER Mfg. Division
Bradford, Pa.

DRESSER Mfg. Company, Limited
Toronto, Ont., Canada

INTERNATIONAL Derrick & Equipment Co.
Beaumont & Dallas, Texas; Torrance, Calif.; Columbus, Marietta & Delaware, Ohio

KOBE, Inc.
Huntington Park, Calif.

PACIFIC Pumps, Inc.
Huntington Park, Calif.

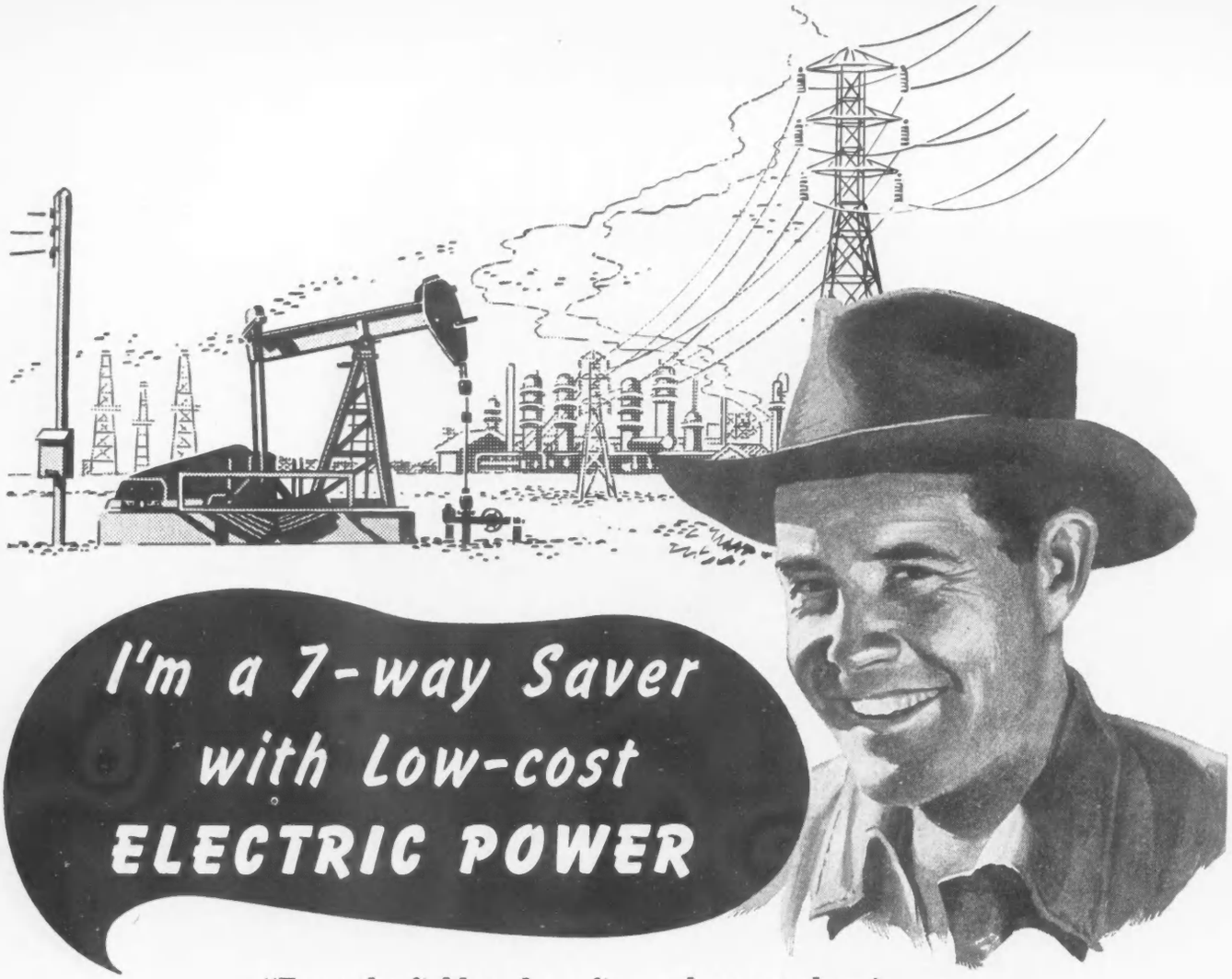
PAYNE Furnace Co.
Beverly Hills, Calif.

ROOTS-CONNERSVILLE Blower Corp.
Connersville, Ind.

SECURITY Engineering Co., Inc.
Whittier, Calif.

STACEY BROS. Gas Construction Company
Cincinnati, Ohio

Stacey-Dresser Engineering Division
Cleveland, Ohio



I'm a 7-way Saver with Low-cost ELECTRIC POWER

"From the field to the refinery, low-cost electric service has solved my power problems efficiently, economically and, most important of all, dependably."

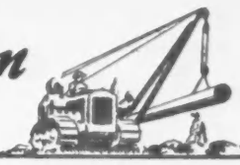
Here are just a few of the many advantages made possible by the use of electric power:

1. LOW FIRST-COST OF POWER-DRIVEN EQUIPMENT. 2. LOW OPERATING, MAINTENANCE AND LABOR COSTS. 3. DEPENDABLE, DAY AND NIGHT, ALL-WEATHER PERFORMANCE. 4. HIGH SALVAGE VALUE. 5. EXTREME PORTABILITY. 6. LESS TROUBLE, FEWER REPAIRS, SMOOTH OPERATION. 7. HIGH SAFETY FACTOR.

Houston Lighting & Power Company engineers will gladly discuss your power requirements for field or refinery.

HOUSTON LIGHTING & POWER COMPANY

PIPE LINE *Construction*



ARABIAN American Oil Company has resumed its pipe rolling schedule with West Coast's Consolidated Mills, and plans to have on hand 43,000 tons of line pipe for lifting by the end of the year. This action was taken in anticipation of the Department of Commerce's approval of steel export license application made by Trans-Arabian Pipe Line Company, Aramco subsidiary.

The department failed to include TAPline pipe in the fourth quarter export quotas, but chances of its inclusion in next year's first quarter allowable seem favorable. On strength of this probability, Aramco is going ahead with mill operations. The pipe is needed to continue construction of the 1100-mile line from the Persian Gulf to Sidon, Lebanon.

Of particular interest in November was the awarding of contracts for laying of a 22-inch crude oil line from Cushing, Okla., to Wood River, Ill., for Shell Pipe Line Corporation and The Texas Pipe Line Company (Ozark Pipe Line Ssystem). This project will connect with other proposed lines to link Jal, N. M., with East Chicago. The Cushing-Wood River contracts went to three contractors, but no decision on starting dates has been announced.

Initial pipe deliveries will be made early in January, 1949, to The Atlantic Pipe Line Company for construction of its second outlet from West Texas to the Texas Coast. The new carrier will be about 400 miles of ten-inch welded pipe and will run from the Block 31 field, Crane County, to Refugio where it will connect with Atlantic's discharge line to Harbor Island near Corpus Christi.

Pipe Line Construction

Table includes projects planned, contracts awarded, and spreads or entire projects completed since the last issue of WORLD OIL.

COMPANY	Origin and Terminus	Length (Miles)	Pipe Size (Inches)	Daily Capacity (Barrels Cu. Ft.)	REMARKS
CRUDE OIL LINES					
Continental Pipe Line Co.	Fields south of Joy to line at Ringgold-Joy junction, Clay Co., North Texas.	10	4	.....	Completed by C. L. Rogers Construction Co., Wichita Falls, Texas.
Houston Pipe Line Co.	East of Houston to Village Mills, Upper Texas Coast	65	12	.....	Latex Construction Co., Houston, has contract to take up pipe in vicinity of Alice, Texas, recondition and lay new line.
Salt Lake Pipe Line Co.	Pump station, two miles east of Hann, Duchesne County, Utah.	..	..	24,000	On new line from Rangely, Colo. field to Salt Lake City. Completed in November.
Shell Pipe Line Corp.	At Wink, West Texas	7½	6 & 10	.....	Reconditioning by McVean & Roberts, Odessa, Texas, to be completed by mid-December.
	Chain of Rocks Canal, Wood River, Illinois	5	8, 10, 16	.....	Relocation of lines completed by Midwestern Constructors, Tulsa, inl ate October.
Shell Pipe Line Corp. and The Texas Pipe Line Co. (Ozark Pipe Line System)	Cushing station, Okla. to Verdigris River, Okla.	79	22		Contract awarded to Midwestern Constructors, Tulsa. 1 spread.
	Verdigris River to Roxdale station, Missouri	160	22	200,000	Contract awarded to Smith Contracting Corp., Ft. Worth 2 spreads.
	Roxdale station to Wood River, Illinois	220	22		Contract awarded to Anderson Bros. Corp., Houston. 3 spreads. Starting dates for these 6 spreads will be announced later.
Sinclair Refining Co., Pipe Line Division	Murrary-Kendall area, Young Co., to Eliasville station, North Central Texas	6	6	.....	Paralleling an old 4-inch discharge line. Completed late Oct. by C. L. Rogers Construction Co., Wichita Falls, Texas.
	Eliasville station to two T. P. Coal & Oil Co.'s discoveries in northern Stephens Co., North Texas	7½	4	.....	Contract awarded to C. L. Rogers Construction Co., Wichita Falls, Texas.
Socony-Vacuum Oil Co., White Eagle Division	Big Horn Basin field to Casper, Wyoming	122	8	.....	Planned.
Stanolind Pipe Line Co.	Near Douglas, Wyo. loop on Casper to Freeman, Mo. line	30	16	.....	R. H. Fulton & Co., Lubbock, completed these two loops in Mid-November.
	Near Wheatland, Wyo. loop on Casper to Freemen, Mo. line	23	12	.....	
	Near Douglas, Wyoming	50	8 & 12	.....	This loop was taken up by the same company.
Texas Pipe Line Co.	West Columbia station to East Houston station, Upper Texas Coast	60	16	60,000	Completed by Latex Construction Co., Houston, Line connects at E. Houston with completed 20-inch carrier to Port Arthur, Texas.
Texas-Empire Pipe Line Co.	Cushing to West Tulsa refinery, Oklahoma	47	10	25,000	Work underway by Williams Bros. Corp., Tulsa. To be completed in December.
	Patoka to Wilmington, Illinois	183	18	69,000	No contracts have been let on this project.
	Loop from Wilmington toward East Chicago	31	16	.....	Main line construction to start early in 1949 and scheduled for completion in Sept., 1949. Loop to be undertaken in Spring, 1950. Stations to be let around first of year.
	Diesel Pump station at Patoka	..	..	.....	
	Motor Pump station at Wilmington	..	..	.....	
NATURAL GAS LINES					
El Paso Natural Gas Co.	Quartsite to Yuma, Arizona	75	5	4 mln	Completed in November by company crews.
Home Gas Co.	Horsehead to Dundee, N. Y.	25	10		
		10	4, 6, 12	.....	Completed by Britton Contracting Co., Ft. Worth.
Lone Star Gas Co.	Sulphur Springs to Paris, East Texas	40	10	.....	Latex Construction Co., Houston, completing.
Mesabi Pipe Line Co.	Keokuk, Iowa to Itasca Co., Minnesota	400	18	.....	Applied to FPC. Application also includes 40 miles of lateral lines.
Northern Natural Gas Co.	Loop from Clifton station northeast to Washington Co., Kansas	11$\frac{11}{10}$	24	.....	Started by J. R. Horrigan Construction Co., Houston.

TABLE CONTINUED ON NEXT PAGE

Pipe Line Construction—(Continued)

Table includes projects planned, contracts awarded, and spreads or entire projects completed since the last issue of WORLD OIL.

COMPANY	Origin and Terminus	Length (Miles)	Pipe Size (Inches)	Daily Capacity (Barrels Cu. Ft.)	REMARKS
NATURAL GAS LINES—(Cont'd)					
Ohio Fuel Gas Co.	Near Sugar Grove, Ohio	40 90	20 4, 6, 8, 10, 12, 16	.....	Midwestern Constructors, Tulsa, laying 20-inch and taking up rest. Completing early December.
	Eight miles east of Lima to near Mansfield, Ohio	74	8	.....	H. L. Gentry Construction Co., Jackson, Mich., is removing this line and plans to complete about May, 1949.
Panhandle Eastern Pipe Line Co.	Hansford, Kansas, loop Liberal, Kansas, loop Greenburg, Kansas, loop Haven, Kansas, loop Olpe, Kansas, loop	10⅜ 22½ 25⅝ 26⅝ 27⅛	26 26 26 26 26	....	R. H. Fulton & Co., Lubbock, Texas, has contracts for these five loops. Hansford, Liberal and Haven loops are now completed. Greenburg and Olpe in Dec. and Jan. respectively.
	Centralia, Missouri, loop Pleasant Hill, Illinois, loop Glenarm, Illinois, loop	15 10⅝ 17⅛	26 26 26	....	These three loop lines have been completed by Midwestern Constructors, Tulsa.
	Louisburg, Missouri, loop Houstonia, Missouri, loop	24 18⅝	26 26	....	Louisburg line completed in Nov. Houstonia scheduled for Mid-Jan. R. B. Potaschnick, Cape Girardeau, Mo. has contracts.
Peoples Natural Gas Co.	From line near New Kensington to Mt. Royal Storage field, Allegheny Co., Pennsylvania	12	12	.....	Completed by Williams Bros. Corp., Tulsa.
Public Service Co. of Northern Illinois	Marseilles to Seneca, Illinois	6	6	.....	Completed by Midwestern Contractors, Chicago.
Regie Autonome des Petroles	Toulouse to Agen, France	68	8	7 mln	First section of Toulouse-Bordeaux 149-mile line is complete and will be put into operation this year.
Stanolind Pipe Line Co.	Repressuring system at Pettus field, Southwest, Texas	75	40 to 10	.....	Started by Morrison Construction Co., Odessa, Texas.
Texas Eastern Transmission Corp.	Waskom field to TETCO 20-inch line at Jefferson, Texas. Hico-Knowles field, La. to TETCO 20-inch line	29¾ 7⅛	8, 10, 12 12 & 14	....	Started by Brown and Root, Inc., Houston. Will be completed this year; also includes 1½ miles 7-inch from Bryceland field to 20-inch line.
Tennessee Gas Transmission Co.	Edna to Tomball, Upper Texes Coast Fairdale, Texas to Natchitoches, La	79 55	30 & 31 30 & 31	....	Both spreads completed by H. C. Price Co., Bartlesville, Oklahoma.
	Station 14, near Catlettsburg, Ky. to Cornwell station, W.Va.	89	24	.....	Completed in Nov. by Oklahoma Contracting Co., Dallas.
United Natural Gas Co.	Roulette to Wharton, Pennsylvania	20	12	.....	To be completed in Dec. by Williams Bros. Corp., Tulsa.
Western Natural Gas Co.	Benedum field, Upton Co., West Texas, to its line at Jal, New Mexico	110	20 or 24	.....	Construction contemplated.

Empire Trust Company

NEW YORK

Capital Funds .....$ 8,915,863.61
Total Resources 128,880,113.35

Directors

DEAN MATHEY
Chairman of the Board

FRANK V. BALDWIN
Retired

C. KENNETH BAXTER
Chairman of the Board
Deep Rock Oil Company

JOHN T. CAHILL
Cahill, Gordon, Zachry & Reindel

EVERETTE L. DeGOLYER
DeGolyer & MacNaughton
Dallas, Texas

GEORGE A. EASLEY
Vice President, Salt Dome Oil Corp.

DEAN S. EDMONDS
Pennie, Edmonds, Morton & Barrows

CHARLES S. GARLAND
Alex, Brown & Sons
Baltimore, Maryland

ARCHIBALD A. GULICK
Alexander & Green

PAUL H. HUDSON
Executive Vice President and Secretary

JOHN L. LOEB, Partner
Carl M. Loeb, Rhoades & Co.

GRAHAM D. MATTISON
Dominick & Dominick
New York

HENRY C. BRUNIE
President

DONALD H. McLAUGHLIN
President, Homestake Mining Co.

JULIAN S. MYRICK
Vice President, Mutual Life Insurance Co.

CLENDENIN J. RYAN
President, Big Horn Cattle Co. of Colorado

ARTHUR A. SEELIGSON
President, Transwestern Royalty Co.
San Antonio, Texas

JAMES H. VAN ALEN
Vice President, Farrar, Straus & Co., Inc.

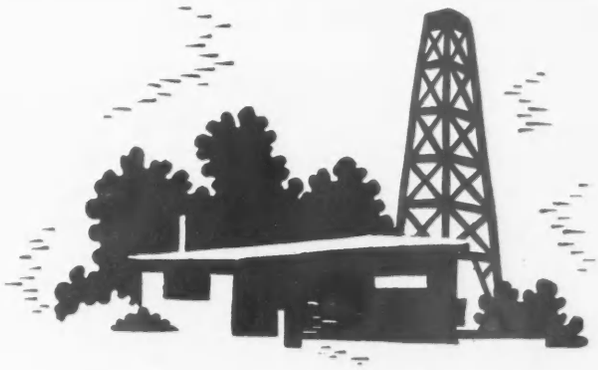
Specialized experience is available for study and suggestions as to sound financing of oil properties.

Main Office
120 BROADWAY, NEW YORK

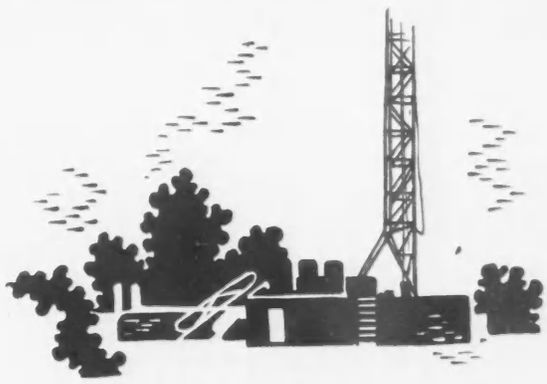
Fifth Avenue Office
580 FIFTH AVENUE

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Times have changed in the Oil Industry

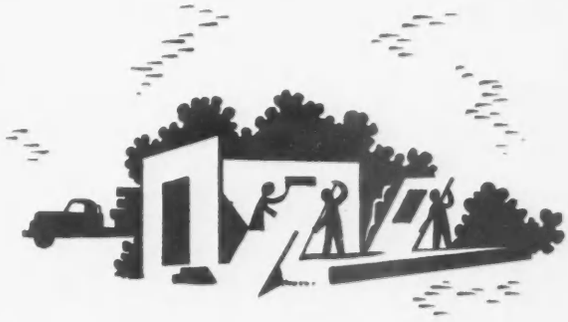


Years ago portable rigs and derricks were unheard of. All drilling equipment had to be assembled on location.



Modern, portable equipment has replaced "hand made" equipment. New methods brought new progress to the oil industry.

In the past, oil field camps were built from material hauled to the site, and completed after long weeks of work.



Now, STURDYBILT Prefabricated, Demountable Houses make it possible to erect oil field camps in *days* instead of *weeks.*

STURDYBILT

SOUTHERN MILL & MANUFACTURING CO.

• TULSA, OKLAHOMA •

Prefabricated, Demountable Houses

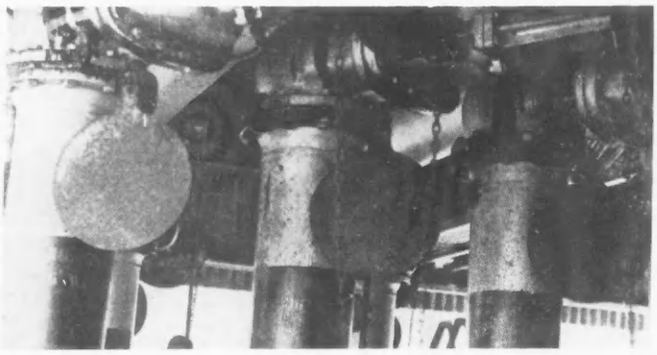
STURDYBILT HOUSES COMPLY WITH COMMERCIAL STANDARD CS125-45 OF THE NATIONAL BUREAU OF STANDARDS FOR PREFABRICATED HOMES

How to do it!

PIPE LINE HINTS

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

HOW TO—Identify Blind or Gasket Installation

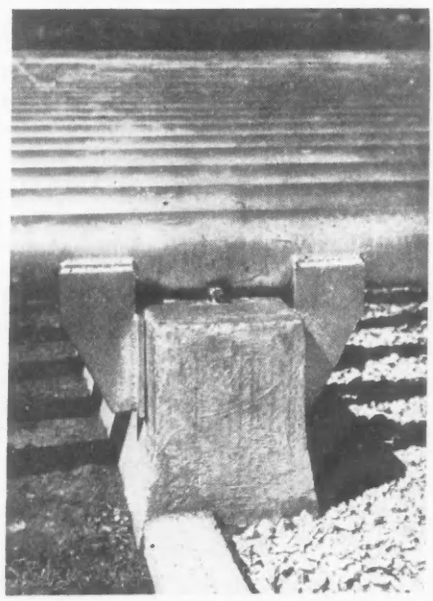


So that certain lines of a manifold can be quickly blinded off to prevent escape of oil through gate valves, flanges and the like from one line to another when making repairs or changing fittings, blinds and companion gasket rings are made in pairs and one or the other is always between the plates of the flange. The gasket rings and the blind plates are cut from heavy flat steel to the outside diameter to fit between the row of flange bolts. Both the blind plate and the gasket ring have tabs at one side so both can be clipped together with a chain link.

The gasket ring is cut with an inside diameter to allow full throat flow of oil when the line, or manifold, is in operation, and fits between two conventional ring, asbestos-composition or metallic gaskets to obtain a seal. When the line is to be blinded off, the gates on each end are shut and the flange opened by removing the number of bolts required to loosen the flange and allow the gasket ring to be withdrawn so the companion blind-plate can be inserted immediately, the bolts inserted and drawn up tightly. If that portion of the manifold blinded off is to be removed entirely a companion flange is used to retain the blind-plate. With the pair of fittings always connected to each other, one or the other in place, no time is lost by running to a warehouse to obtain the correct size and thickness blind plate.

HOW TO—Snub Line Expansion

To curb the tendency of long lines to travel under temperature changes, and to direct the expansion so as to prevent overloading any fittings, one pipe line company utilizes a heavy concrete wall, which also acts as support for the lines at that point. The anchor fitting consists of a saddle, fitted to half the pipe diameter, and welded all around to the pipe. To the sides of this semicircular support are welded two vertical members of heavy plate, carrying between them a plate of the same thickness. This last plate serves as a bearing against the face of the concrete wall, and is opposed by a similar fitting on the opposite side of the wall.



The two bearing plates are wide enough to distribute any thrust over a wide area of the concrete, and have just enough slack between the two members of a pair to permit it to shift laterally if expansion in the pipe requires movement in a transverse direction.

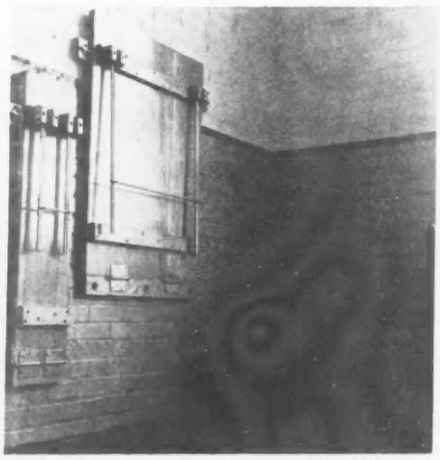
Use of the paired anchor plates anchors to the wall the section of pipe between them, and forces expansion or contraction changes to be progressive in either direction from the anchor.

HOW TO—Add Lunch Facilities at Pump Station

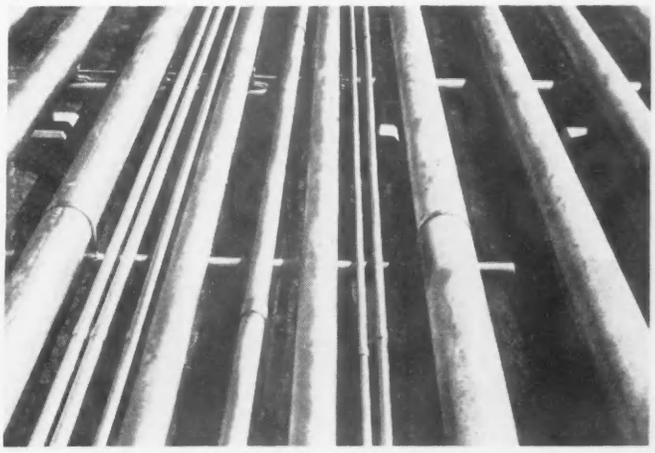
Provision of a table and seats within the average trunk-line pump station usually involves a sacrifice of space which is used by the operators only a small portion of the time, and places obstacles which must be moved if a major overhaul of station equipment is under way.

One pipe line provides for mealtimes a folding table and benches which are hinged to the wall, and which lift up and latch out of the way when not in use.

Table and both benches are equipped with hinged legs or outer supports which fold back against the surface members when the latter are raised, but which swing out when table or bench is lowered.



HOW TO—Support Small Lines Between Spans



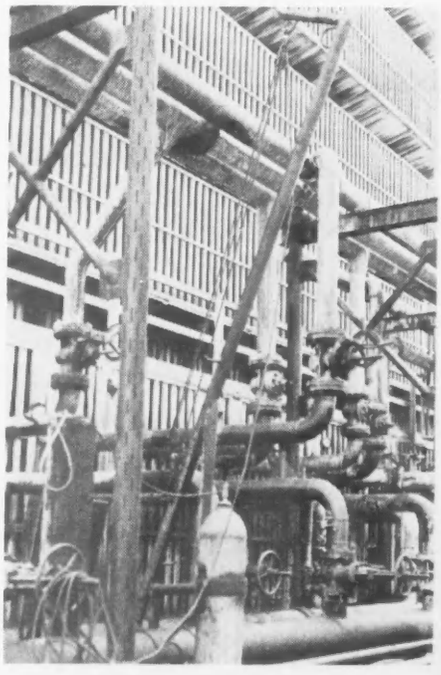
Small lines, carried across the tank farm along with, and parallel to the larger flow distribution system, can be supported between the spans which are suited to the larger pipe by an ingenious method developed by a products pipe line company.

Since the smaller lines would sag between the concrete supports which carry the larger pipes, intermediate supports are set between the concrete bases, and supported from conveniently located larger pipe. The support consists of a short length of one-inch pipe, fastened to the two larger lines by straps and bolts, and so set that the short transverse one-inch lines halves the distance between concrete supports. The small lines are then laid across the supporting members in the usual manner, and are carried without sag and still with latitude to expand or contract without damage to any fittings.

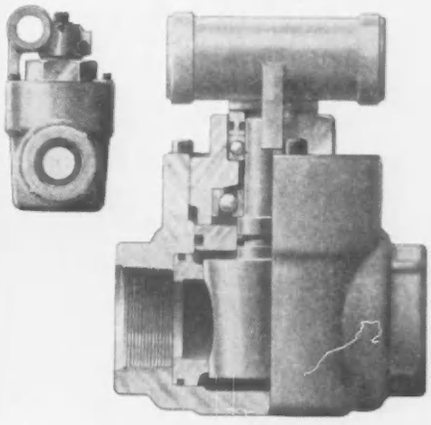
To forestall rust within the one-inch supports, the ends are welded shut before the unit is painted and suspended in place.

HOW TO—Lift Bug Screen from Water Filter

A series of three or four screens set in the outlet flume of a water cooling basin leading to the circulating pump suction pits of necessity are installed with a tight fit in the guides. These screens may be removed easily by one maintenance man with the assistance of a davit to operate a light block and tackle. The davit is installed at an angle to match the angle of the screen frames so that a straight-line pull can be applied. A short cross-arm at the top of the post of the davit has a heavy metal loop into which the hook of the upper blocks is inserted. Each of the screen frames has a similar loop attached to the top cross member. This is used to attach a chain or the hook of the lower set of blocks when the screens are to be pulled for cleaning away foreign matter. This davit for the block and tackle not only assists the maintenance man but makes crow bars unnecessary for prying the frames loose from the guides when they become water-soaked from continuous use.



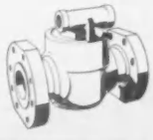
TANNER
HIGH PRESSURE
VALVES



NEED NO
ADJUSTMENT

The plug in this valve is non-adjustable and is firmly seated at all times. High quality ball bearings take the upward thrust of the plug while the valve is under pressure, and prevent the plug from dropping and becoming wedged between the seats while the valve is not under pressure.

These valves are used in DRILLING, CEMENTING and PRODUCING. Available in either flanged or screwed ends. Valve sizes range from 1" to 4".
Write for our catalog for complete details.

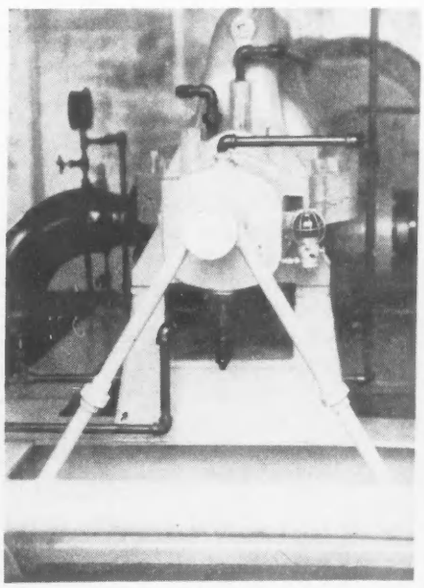


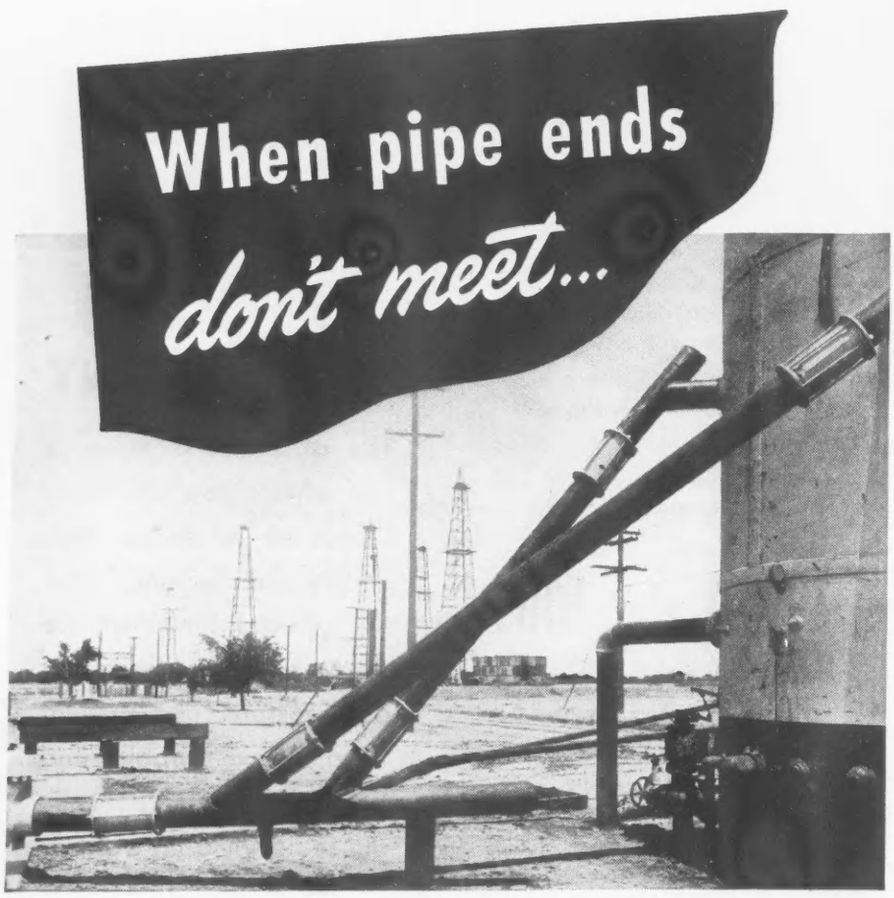
C. L. TANNER CO.
6887 Farmdale Avenue
North Hollywood, California

HOW TO—Cover Exposed Pump Shafts and Protect Station Crew

The outboard end of a high-speed centrifugal pump, extending beyond the bearing shell, not only presented a hazard to the station crew, but also tended to sling oil and to mar the clean appearance of the frame.

To cover the shaft, yet leave it free for speed determinations when needed, as well as to allow oil to work through the outboard packing and thus prevent overheating, a short section of three-inch pipe, one end blanked off with a disc of plate, was supported on two pipe legs so as to fit closely up against the bearing block, and to surround the protruding end of the shaft.





Dresser Long Sleeves join 'em tight

Want to speed up pipe joining at wells, separators, Christmas trees? Want to eliminate slow threading, exact lengths and lining up? Then get Dresser Long Sleeves (Style 40) from your oilfield supply store or our Houston warehouse. They span the gap, make tight, vibration-proof joints every time.

DRESSER STYLE 40 LONG SLEEVES

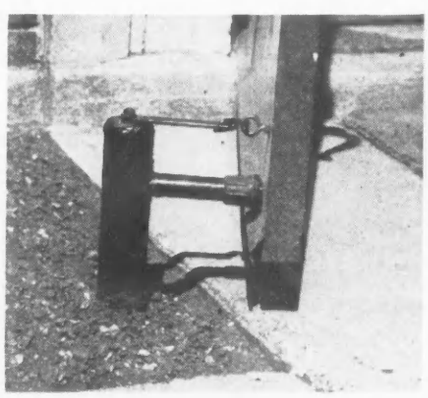
ONE OF THE DRESSER INDUSTRIES

Dresser Manufacturing Division, Bradford, Pennsylvania
Houston Warehouse, 1121 Rothwell St., Houston, Texas

HOW TO—Construct Door Stop

To check the rattling of a door against the latch required to hold it open, one superintendent added a stop member to the usual post, welding it in position to rest against the door below the eye-bolt in which the hook is engaged.

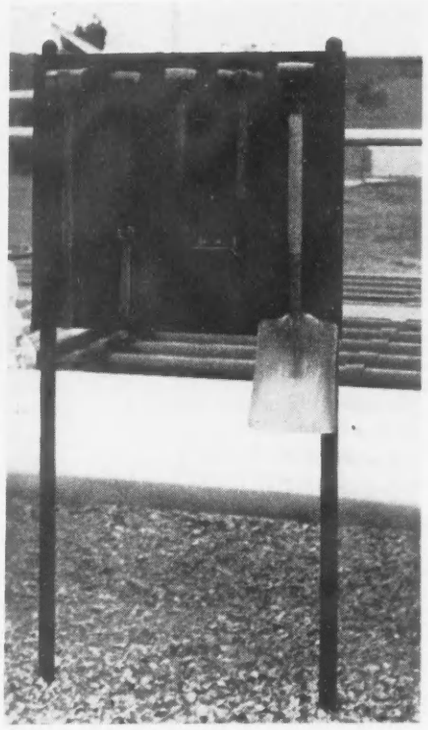
The end of the post is blanked off to carry the hook, so it may be swung around out of engagement, and the end of the stop is likewise closed off with a welded plug. In the latter instance it is closed off to provide backing for the rubber crutch tip which is used to form a buffer for the door, and which also acts to hold the door against the hook without slack.



HOW TO—

Rack Special Tools

To prevent the use of unauthorized and possible spark-generating tools at the switching manifold, one products pipe line company provides a tool board, mounted adjacent to the manifold,



whereon are displayed hammers, sledges, shovels and wrenches of bronze or other non-sparking metals, each hanging in its special place on the stand so as to be readily available.

The board is painted black, to offer contrast to the tools and speed up their selection. The black board is also in direct contrast to the aluminum painted lines.

HOW TO—

Indicate Waste Oil

An indicator, which shows at a glance the relative level of the waste oil in a pipe line sump, was made with the indicator face resembling a large clock, but with only one hand for a pointer. The face of the indicator was made by painting white a circular plate of light

Fair Exchange is Good Business in *Mid-America*

In Mid-America's pioneer days, men exchanged their goods and their labor for the products of the forge. Today, as Sheffield supplies Mid-America with steel from Mid-American mills, the principle of "Fair exchange" is relatively unchanged.

For example When you exchange dollars for any of the many and varied Sheffied steel products, the exchange is just beginning.

Sheffield spends those dollars with you—directly in the purchase of materials such as coal, coke, limestone, petroleum products, agricultural products, electric power, fire brick and many others. Or indirectly in the wages paid to Sheffield employees. Those wages ultimately help pay you for your daily work, for they are spent for the many things needed in modern living.

Because more of every dollar spent for Sheffield steel products stays at home—in Mid-America—more and more manufacturers east of the Rockies and west of the Mississippi are specifying Sheffield Steel and putting "fair exchange" to work for Mid-American prosperity

SHEFFIELD STEEL CORPORATION
HOUSTON KANSAS CITY TULSA

SALES OFFICES: Chicago, Ill.; St. Louis, Mo., Des Moines, Ia.; Omaha, Nebr.; Wichita, Kans.; Denver, Colo., Oklahoma City, Okla.; Dallas, Tex.; San Antonio, Tex.; Lubbock, Tex.; New Orleans, La.; Shreveport, La.

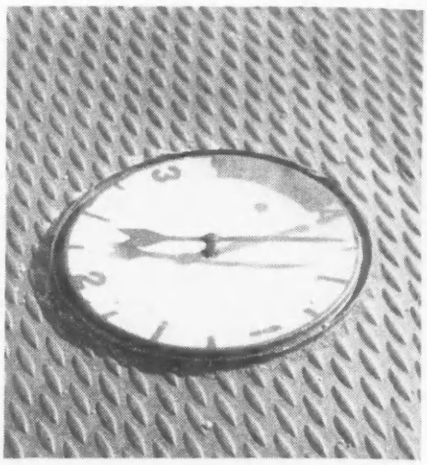
EAST OF THE ROCKIES...WEST OF THE MISSISSIPPI

Carbon and Alloy Steel, Ingots, Blooms, Billets, Plates, Sheets, Merchant Bars, Steel Joists, Structural Shapes, Road Guard, Reinforcing Bars

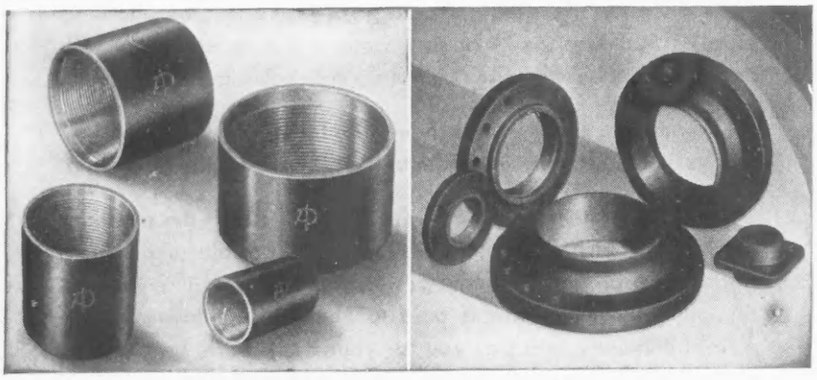
Welded Wire Mesh, Wire Products, Wire Rods, Fence, Spring Wire, Nails, Rivets, Grinding Media, Forgings, Track Spikes, Bolt and Nut Products

metal set in a retaining rim. Divisions marked around the face show whether the sump is one-fourth, one-half, or three-quarters full, and a division following, painted in red, shows the danger point at which the sump must be pumped out to prevent a spill.

The actuating device is a conventional buoyant float with guide lugs running on vertical rods. The stem or rod that moves the pointer hand is a square rod smoothly twisted from one end to the other for only one complete turn. The float contains a hole fitted with a square grommet to slide up and down on the square pointer rod, turning this rod one complete turn clockwise from empty to completely full indication. Steel beams placed over the sump support the clock-face indicator and the safety covering.



HARRISBURG



Oil Field Products

PIPE COUPLINGS

Made to A.P.I. Specifications

Harrisburg Seamless Steel Couplings owe their superiority to almost thirty years experience plus carefully controlled inspection. The accuracy of the threads in a Harrisburg Coupling assures a perfect leak-proof joint. Available in all sizes and types.

PIPE FLANGES

Manufactured to A.S.A. Standards

It is the accuracy of machining that assures the strength and endurance found in all Harrisburg Drop-Forged Steel Pipe Flanges. Threads are perfect in height, angle, taper and gauging. Forged from Harrisburg's own steel and furnished in all types and sizes.

We Make Our Own Steel

Because Harrisburg makes its own steel, complete control of the manufacturing process is assured from open hearth to finished product. Add to this Harrisburg's years of experience in the proper heat treatment of specific products and you have the answer to Harrisurg's superiority in the field.

Send for Complete Catalogs

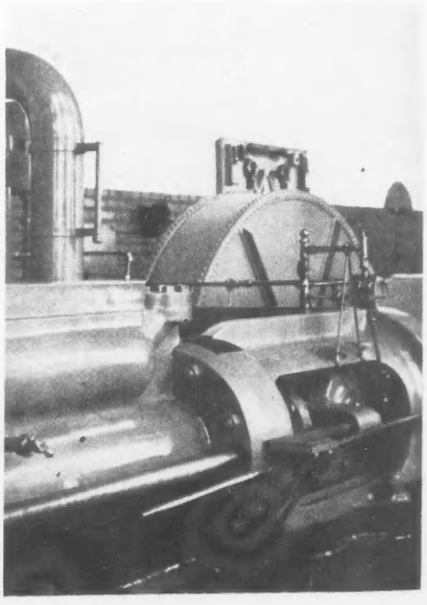
HARRISBURG STEEL CORPORATION
HARRISBURG, PENNSYLVANIA

HOW TO—

Make Oiler's Walkway

To provide access to the space between the two sides of a duplex pump, one pipe line company equipped the unit with a rubber-covered step halfway up the side of the diameter of the cylinder casting, applied a second rectangle of non-skid material to the top of the pump casting, and a third inside the frame so that the oiler or engineer could be sure of his footing while crossing over the unit.

Further to insure safety of the man crossing the pump casting, a handle or grip was attached to the riser of the suction surge-chamber support,, so that it would be conveniently at hand as the man started to use the steps to mount the pump.



Modern Methods feature PERU'S Oldest Operation

THE FIELDS in the Talara-Negritos area of Peru have served as a proving ground for basic conservation principles for more than two decades. Thus, one of the oldest producing regions in the Western Hemisphere is the site of one of the most modern operations, with sound practices in both primary and secondary production paying dividends in increased yield.

THE La Brea-Parinas estate owned by International Petroleum Company in the coastal area of Northern Peru is the site of one of the most interesting operations on the South American continent. It was here that the first commercial production on the continent was found, and yet, after more than 75 years of continuous activity during which comparatively little additional productive area has been added, the producing fields are still being expanded.

Commercial operations have been carried on since before 1870, but there is ample evidence that the ancient Incas were availing themselves of seepage oil there at the time of the Spanish Conquest. Centuries later the fields are still in active exploitation and using the most modern methods of drilling, production and conservation.

The Incas found many uses for the cementing and waterproofing properties of the petroleum they dug from the pits at the pitch deposits they referred to as "The Pits of the Kings." The Spaniards later shipped it to Callao at the mouth of the river below Lima and used it in painting and caulking ships. The Spaniards also found that it could be reduced by distillation, and used iron kettles to heat the crude petroleum and recover kerosine, carrying on what is perhaps the oldest refinery operation in the Western Hemisphere. The first record of refinery operations in the U. S. was the distillation of crude by Samuel Kier in 1850. Actually, commercial refining did not start in Peru until many years later and production statistics only date from 1890.

The 643-acre estate was purchased by International from the London & Pacific Petroleum Company, Ltd., in 1914. At that time there had already been 659 producing wells drilled on the property in addition to 138 dry holes. International has since carried on an active drilling program which has accounted for more than 3800 wells, developing the original shallow formations and finding deeper zones until now production has been found from 60 feet down to 6500 feet.

Unique Operation

Although the 28,000-barrel daily output from the property is comparatively small when viewed from the standpoint of the tremendous quantities of petroleum being produced and consumed in the world today, it is an extremely interesting operation for a number of reasons. It entails production of every type from stripper wells making less than one-half barrel a day each, to flowing wells averaging several hundred barrels a day. Its operation is unique in that although the bulk of the productive area had been discovered nearly 50 years ago, the structural character of the productive horizons is such that a number of rigs have to be kept busy constantly on drilling of an exploratory nature. So complex is the faulting that each producing field is divided into countless small reservoirs requiring constant study by competent sub-surface geologists and reservoir engineers, and making any stepout drilling operation an exploratory project. Every cubic foot of gas produced is treated with the respect it deserves as a source of heat and energy and is carefully collected and processed. That portion not actually used as fuel for useful work is returned to the proper reservoirs where it can help preserve the flowing life of wells. Gas is even collected from the stripper wells and compressed for injection into newer areas

Talara—International Petroleum Company's headquarters in Northern Peru. In the foreground is the new ultra-modern workers' camp.

which lend themselves to repressuring and pressure maintenance. Such a program has been followed for the past 25 years and has paid substantial dividends in the form of extra recovery. An additional dividend is the natural gasoline and other products recovered from the gas, amounting to roughly 1 million barrels a year.

It must be remembered that such an operation is completely feasible in this particular case, where the whole property is an estate owned in fee by one company. It has therefore allowed development on a planned long-range program looking toward maximum recovery from the reservoir rather than maximum recovery within a given time and at a minimum of expense.

While the operations on the La Brea-Pariñas estate are thought to be a decade ahead of the U. S. in the matter of most complete utilization of gas, the conversion of the drilling department to rotary drilling was not completed until quite recently. Rotary rigs have been in use on the estate for some time, but a considerable number of cable tool outfits were busy until 1947 when the last of them were retired in favor of the rotary. The use of cable tools for development work was extended several years beyond the point where operators would have changed over, but for the intervention of the war and consequent shortage of all types of equipment.

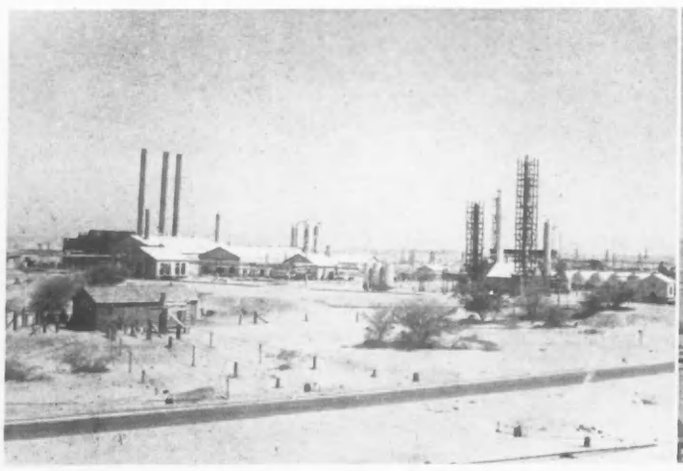
Tertiary Production

All of the present producing horizons are in formations of Tertiary age, and although some production is found at 6500 feet, the majority of the drilling is to depths of 3000-4200 feet.

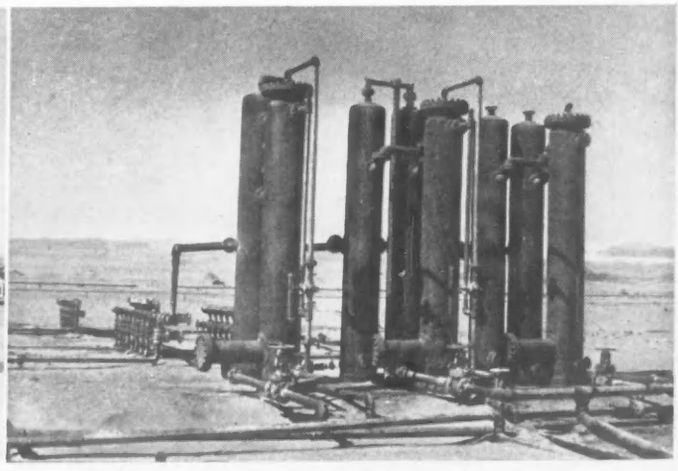
International has secured rigs as they became available, looking at the same time toward deeper drilling in the future, so that a number of the rigs are heavier than needed for the work they are now doing. Some rigs capable of drilling to depths of 12,000 feet are being used on 3000- and 4000-foot holes. Since the last four cable tool rigs have been retired, the company now has 16 rotaries on the estate, including two portable rigs for shallow drilling. All but three are steam powered. Steam has been found very practical here, since operations are concentrated in a relatively small area and both gas and water are available in sufficient quantities.

The productive Eocene formations are separated into five principal producing zones—sandstones isolated by thick shale beds. Most of them are relatively thin sections with the exception of the Massive Parinas, which in some places has a thickness of several hundred feet with effective oil pay thickness of more than 150 feet. The four main sands overlap in only a few restricted areas.

The primary reason for accumulation of oil in the area is a major uplift associated with an extension of the basement rocks from the Andes Mountains to the west. A geological column shows some



The central gasoline plant at Verdun, where enriched absorption medium from five other field plants is stripped. In left foreground is one of several central power installations for pumping stripper wells.



Typical two-stage separator setup in Talara-Negritos area, where high-pressure gas goes directly to gasoline plants and oil to central storage.

thin Pleistocene beds on top, but no Pliocene or Miocene. Below the Eocene the Cretaceous consists predominantly of marine shales with no permeable formations. All of the presently exploited areas are accumulations associated with block faulting in the Eocene, with none of the younger formations productive in tests drilled to date. A number of deep tests have been drilled, one going to 11,540 feet as the deepest well in Peru, but all of the deep wells have been disappointing. The current opinion is that there is very little possibility of any deeper production in the developed areas.

The area for exploration is restricted toward the north and south of the Talara-Negritos group of fields, since it is known that both north and south of the major uplift they are too deep for exploitation. It is therefore thought that the principal prospects for increasing reserves on the estate lie in extensions to, and filling in of, presently producing areas.

Complex Structures

In this respect the operation is not too encouraging, since in moving progressively out into the flank areas, the formations lie deeper and are not getting any better from the standpoint of reserve, so that smaller quantities of oil are returned per foot of productive hole drilled. It does serve to replace oil withdrawn and to maintain production fairly constant at about 28,000 barrels a day from the entire group. Due to the complex faulting, half of the 16 rigs are constantly drilling outside wells, trying to define fault blocks for development. A peculiarity of the area is the great difference between the producing fault blocks as compared with the surface structure. No way of definition has been found other than drilling, and quite often it is necessary to drill three wells to locate one small fault block. These small fault blocks are themselves usually found to be broken into lesser blocks.

The present drilling depths range from about 3000 feet to about 4200 feet. Formations are relatively hard and abrasive so that there is very little drag bit drilling. Most wells are drilled from top to bottom with rock bits, requiring from 18 to 30 bits per well. In this particular area it has been found by experimentation that good penetration results are obtained by running considerable weight on the bit and turning at the arte of 140 to 180 revolutions per minute. Normal drilling time from spudding to cementing casing is about 20 days. Another five days are consumed in completion of the well, and another five in breaking down and setting up on the next well, so that each rig usually accounts for about a well a month. For the most part Peruvian drillers are used on the rigs, and tool pushers are both nationals and expatriates. No effort was made to standardize the casing programs during the recent war years when operators were glad to get any size casing. Usually, the surface string was 13⅜-inch or 10¾-inch pipe, with 6⅝-inch oil string and sometimes a five-inch liner. Now there is an effort being made to standardize on 9⅝-inch surface pipe and 5½-inch oil string.

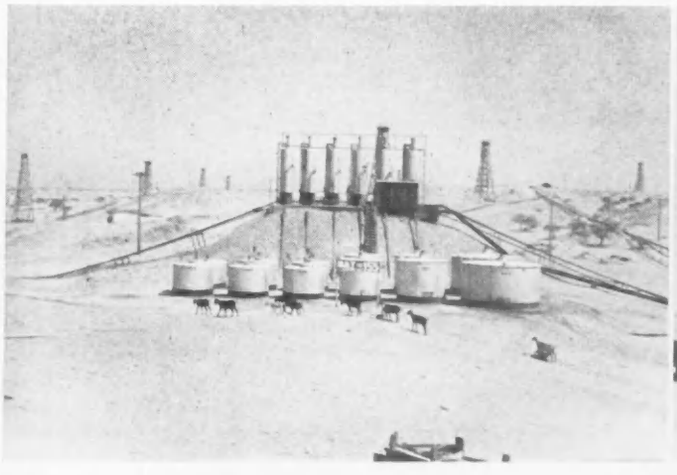
Completion methods vary somewhat with the sand in which completion is is being made. In all of the Parinas sand wells, which account for most of the production, completion calls for setting casing through the sand and perforating. In line with the pressure maintenance program, wells are usually perforated as low as possible in order to enhance the gas-cap drive. In other formations, most completions are made with casing set on top of the pay and a perforated liner set through the section. The Verdun, Pale Greda and Salina formations are less permeable and produce much better through perforated liners than perforated casing. It has also become farily general practice to bring the wells in with gas to reduce completion time.

Water-Flooding Experiment

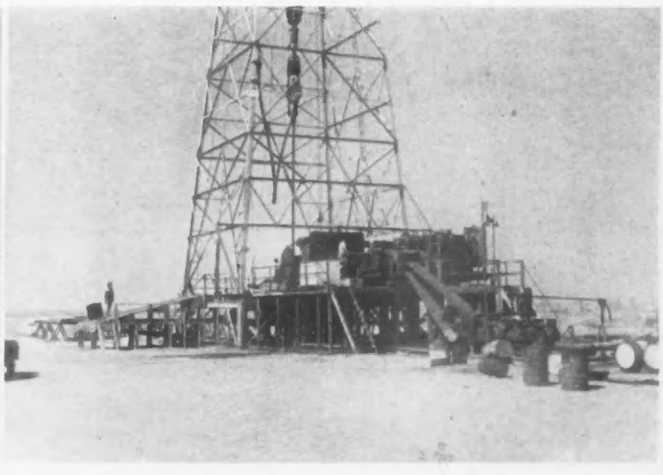
In addition to pressure maintenance by gas injection, the operators are now experimenting with water-flooding in one of the pools in the southern part of the area. A number of such pools in the area are now in an advanced state of depletion, but have been selected for water-flood experiments because of the thick sand bodies with records of high recoveries per acre. The Pueblo pool, site of the first project, has about 200 surface acres, and the experiment is being carried on in a 30-acre fault block. Despite the small area, the block has produced a large amount of oil, since wells have about 600 feet of section of which 60 percent is effective sand. An injection well was drilled near the downdip end of the bolck and the original plan called for injecting around 10,000 barrels of water daily. It was thought that in actual practice it might be found that more water was required, in which case additional wells would have to be drilled.

For the water supply, a seepage box, or pit, was constructed at the ocean front to serve as a reservoir and a settling basin so that sea water could be handled free of suspended sand and injected after running through high pressure filters with anthracite coal as the filter medium.

Preliminary tests with sample cores following a short, unsuccessful attempt at flooding, showed that salt water was satisfactory for the experiment. It was found that fresh water would disintegrate the clay particles binding the sand in this area, whereas salt water did not affect them. Casing was set 200 feet from bottom in the injection well and



Standard placement of batteries, with low-pressure separators higher than tanks. Low-pressure and solution gas goes from separators through vacuum system to gasoline plants.



Modern power rig drilling an outpost at Negritos. This rig, capable of 12,000-foot drilling, is operating to depths of 4200 feet and less.

water introduced into the open hole in an attempt to induce water drive rather than a flushing action. In attempting such an operation on a large scale it is necessary to have absolute information on the fault blocks to be treated, since the blocks themselves are only parts of the principal pools. A pool of about 200 acres is normally made up of innumerable smaller fault blocks with displacements of from 20 feet to as much as 300 or 400 feet, whereas between the pools themselves the throw may be thousands of feet.

An outstanding example of the results of pressure maintenance by injected gas is found in the Mile Six pool where 45 producing wells have accounted for a flowing output of more than 29 million barrels of oil since 1934. This pool covers only 325 surface acres, and the producing wells were drilled to a depth of just above 2700 feet, which took them to within a short distance of the water level. Originally discovered in 1927, the first wells were drilled with cable tools, and the pool was not produced commercially until late in 1933, when it served as a model experimental pool since pressure maintenance has been applied through its producing life. Meantime, all of the wells have been redrilled with rotary tools. In the original drilling most of the wells went only a little way into the top of the Parinas producing formation, while with rotary the new wells were taken on down to water level and old wells redrilled and deepened to the same level, the final development coming several years after gas injection had started.

Success of the project has been phenomenal, particularly in view of the fact that at the time it started, such measures were comparatively unknown and many of the engineering tests had to be made with improvised equipment. Injection of gas into the cap has kept original pressures at a very nearly constant rate and has minimized the intrusion of water. The high permeability of the sand has made it possible to keep the gas-oil and oil-water contacts at a uniform level throughout the pool, and selective gun-perforating has simplified control of gas-oil ratios.

From 1934 until 1946 the field produced nearly 29 million barrels with the bottom-hole pressure maintained through most of the period at about 837 pounds, but early in 1946 a blowout was experienced in one of the wells which caused a pressure drop to 755 pounds after it had blown wild for a full week. This caused a loss of nearly 200 million cubic feet of gas a day along with about 1000 barrels of oil daily. Control has been maintained since that time, although pressures were never brought back to the original level.

Similar results have been obtained in the Section 16 Llano and Rio Bravo pools, the four areas in which pressure maintenance has been carried on since early development. All of these fields are relatively new, as compared with the bulk of the producing area on the estate, yet their 150 wells have accounted for nearly one-fourth the accumulative production from the entire area, in which there are more than 2400 producers, and account for more than 40 percent of current production.

Gas-Gathering System

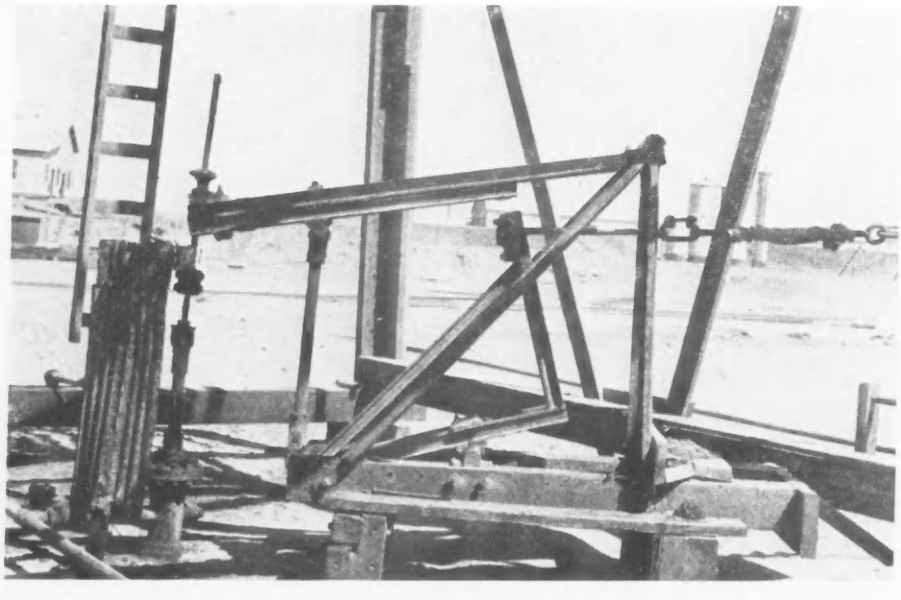
An efficient gas-gathering system has been set up throughout the producing sections of the Talara-Negritos area, so that gas may be taken from all wells and brought in to any one of six processing plants in the field. A high-pressure system serves those areas where two-stage separation is used. The high-pressure wells flow directly into the separators from the wells, where the high pressure gas is taken off to scrubbers and directly on to the gasoline plant. The rest of the gas in solution and oil from the low-pressure and pumping wells, goes on to the field tank batteries, all of which are so placed that the separators are higher than the tanks, and after separation the gas goes back to the gasoline plant through vacuum lines. In all, about 46 to 48 million cubic feet of gas is collected from the fields each day.

Of the six processing plants, the one located at Verdun in the middle of the field is the only one which has steam distillation and stabilization facilities. From the Verdun plant the lean absorption medium is circulated to the other five plants where it is circulated through the absorbers and back to Verdun for stripping and stabilization. Recovery amounts to an average of 2400 barrels of products daily. Most of this is 21-pound Reid Vapor Pressure gasoline, which goes into the Talara refinery for blending, treating and marketing. Recovery in the plants averages approximately 2.7 gallons per 1000 cubic feet of gas processed.

Processed gas is then sent either into the fuel system, where about 45 percent of the total is used, or returned to the reservoir in those pools where pressure maintenance is in effect. Recently it has been found that some of the wells producing gas only are in reservoirs containing nothing but gas, and such wells are now contributing a certain amount of the makeup for repressuring.

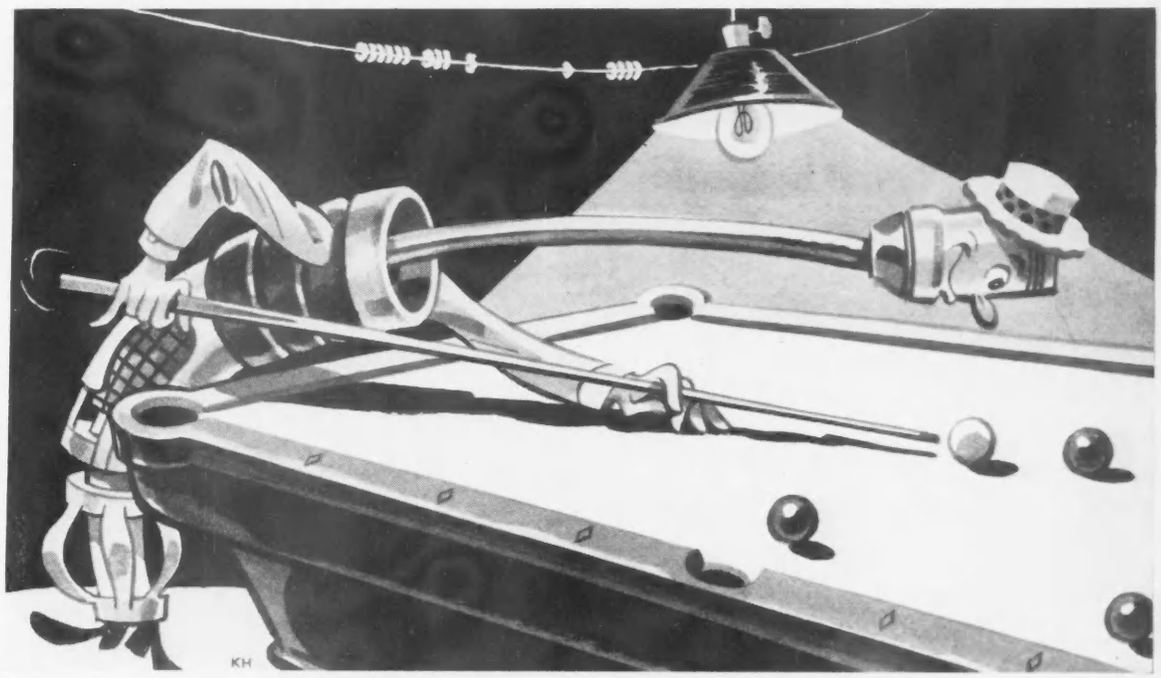
Gas for returning to the reservoir is compressed in from two to four stages, with the system so arranged that gas can be taken off at the various stages. Some wells take gas at no more than 50 pounds pressure in some of the older areas, while in some instances it is necessary to inject at pressures of 2000 pounds per square inch. A saving is effected in some cases by dry gas from high-pressure wells which can bypass the lower stages.

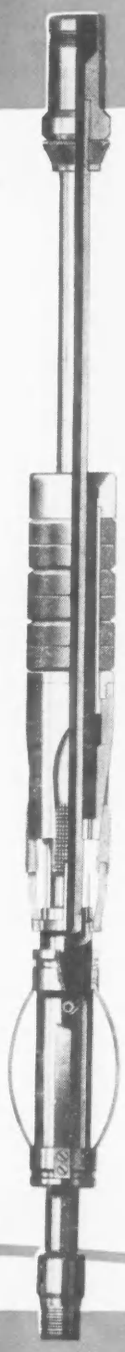
In addition to raw gasoline and stabilized gasoline a number of other products are recovered, including an average of about 20,000 barrels of liquid petroleum gas a day. This is a definite surplus and plans are now under way for the operation of trucks and other powered equipment on the estate with butane. The market for liquid petroleum gas in Peru is expanding rapidly. Most of the populated centers along the coast, including Lima, have no fuel other than wood and charcoal, and LPG is being bottled at the Talara refinery and shipped for use in these centers.



One of hundreds of efficient pumping units operating from central power, fabricated from salvaged railroad iron. Corrugated iron screen serves as partial protection of polished rods and boxes from continuous action of wind-driven sand.

When a Long-Stroke Valve Is Necessary..





... as in deep wells, when tubing stretch is considerable, Lane-Wells BOCL Packer gives the kind of performance that brings pleased smiles to the operator's face. BOCL's long-stroke valve—a full 30 inches—gives perfect control without danger of unsetting the packer when picking up the tubing. You can count on the BOCL to pack off completely when you set it, to release freely when you pull it, and to give you long service. In addition to its long-stroke value it has all the proved Lane-Wells Packer features—Flopak Valve Seal, Floseal Packing Unit, Dovetailed Slips with cross-cut wickers, generous by-pass area for fast running in fluid. Ask your Lane-Wells representative to show you how all these features add up to better packer performance for you.

LANE TECHNICAL OILFIELD SERVICES WELLS

for Packers

General Offices, Export Offices and Plant
5610 S. Soto St., Los Angeles 11, Calif.

24 HOUR SERVICE • 49 BRANCHES

Diplomats Without Portfolio

The American Oil Man Abroad

American workman meets Arabs of Kuwait.

By GEORGE O. IVES
International Editor

INTERNATIONALLY ACTIVE oil companies are adopting a new principle in the recruitment of overseas personnel. An effort is being made to acquaint prospective employes with the lesser as well as the more desirable aspects of life abroad, and to impress upon them a sense of their own responsibility in foreign jobs. This article reviews the factors considered important in making foreign duty a success or failure.

AN AMERICAN working in a foreign country should consider himself literally as a representative of his country and of the company by whom he is employed. This was a basic concept unanimously agreed upon by a panel of experts conducting a special workshop on foreign operations in connection with the recent Texas Personnel Conference sponsored by the University of Texas.

The speakers represented companies operating petroleum and other industries outside the U. S. They were men with a rich background of experience in recruiting personnel for overseas duty, and in observing the performance of American personnel on foreign assignment. Without exception they have had years of overseas duty in capacities permitting them to analyze causes of success or failure of individuals in foreign service.

Chairman of the special workshop was F. Vinton Long, himself experienced in many parts of the world, and now engaged in the independent recruiting of personnel for service in various industries outside the U. S. The program covered every phase to be considered by management or employe and brought out the factors making for successful employment abroad from the standpoint of each.

The breadth of the discussion is shown by the titles of the several talks and the following speakers:

"The Unforgotten Man — Management's Responsibility to the Expatriated Employe," by F. L. George, Socony-Vacuum Oil Company, Caracas, Venezuela.

"Personnel — Essential Characteristics for Successful Performance Abroad," by L. W. Gourley, Richmond Exploration Company, New Orleans.

"Diplomats Without Portfolio," by W. I. Moody, Industrial Relations, The Texas Company, New York.

"Morale—Its Importance in Foreign Employment," by A. J. L. Hume, Industrial Relations, Pan American World Airways, Miami.

"The U. S. Worker in Mexico," by Francisco P. de Hoyos, Personnel Division, American Airlines of Mexico, Mexico, D. F.

Personnel plays a major part in the success of a company engaged in any industry. This is recognized in domestic operations of all types. Its importance is magnified when the company is engaged in foreign operations. It is of still greater importance when applied to a specialized field such as the petroleum industry. Although a substantial part of the personnel group for foreign operations consists of unskilled and semi-skilled labor recruited from the nationals of the country, there is a need for a large technical and administrative staff. It is the policy of most companies to obtain as many competent nationals as possible, but obviously a greater pool of skilled oil workers and technicians exists in the U. S. than in any of the principal countries in which American firms operate. Therefore, to a greater or lesser extent, every American worker abroad is in some sort of administrative capacity. His duties include instructing nationals in the details of various operations. It is here that his real problems begin to be apparent, and

it is here that the company's chief concern as to his success begins. It is at this point that the employe should begin to feel his responsibility, not only from the standpoint of being technically fitted to do the job for which he is hired, but as a representative of the American people. When the conduct of an employe begins to show that he feels this responsibility the company is no longer worried as to whether it has made a bad investment in that man.

From experience gained through many years of foreign operations, the companies have been able to arrive at the basic causes of failure in an employe abroad. While making it clear that they realize their own responsibilities, the companies point out that the basic causes for failure are to be found within the employe's own conduct, outside the demands of the job itself. Taken for granted is the desirability of avoiding excesses in personal habits which reflect adversely upon the individual and his country.

Representatives of foreign employers point out many of the qualifications other than health and ability which an individual should have. To gain the fullest measure of success in foreign employment a company feels that the employe should have:

1. Realization of his responsibility as a representative of his company and his country. Whether he wills it so or not, he is such a representative in the eyes of the nationals of the country.

2. A desire to understand and appreciate the people; to judge them by their own backgrounds rather than by his. He should play down rather than emphasize the differences between standards of living and economic advantages in the two countries. Never make unfavorable comparisons.

Partial view of desert base camp at Kuwait, Persian Gulf. Dwellings are fully air-conditioned.
—Photo Courtesy Hunting Aerosurveys, Ltd.

3. The willingness to make an effort to learn the language, customs, history, and viewpoint of the people, and to try to fit into community life. He should be tactful, and acknowledge the progress of the people under the conditions.

It is an affront to the national pride of a people to make no effort to learn their language or conform as far as is practicable to their customs and laws. It is likewise considered an affront to band together for all purposes and have no contact with the nationals. Insofar as is possible he should avoid making himself conspicuous by spending too much money. Tipping is a good example. Most Americans overtip in foreign countries. It is recommended that he learn the proper level and conform to it.

One of the most obnoxious people, and the one most destructive to morale, is the man who always "has one foot on the boat." This is the one who never seems to be settled in the country in which he is working. He is either just getting ready to leave for home or just back from home; counting the days until it will be time to leave, or counting the days since he came back. He always seems to be looking forward or backward and never at the present. This man is the one who does most to foster the feeling among nationals that the expatriates have a superiority complex.

Why does an expatriate want to leave the U. S. to work in foreign countries? The principal employers of foreign personnel have found that the urges of people to work abroad divide them into three general groups. One small group is composed of romantics. They see glamor in working in strange places, among people whose language and customs differ from their own. Some of these eventually make valuable employes after the glamor wears off, and they decide that after all they were selected to do a job. Others become dissatisfied and a liability to the company.

A second, and larger group has an eye on the future. These see that chances of advancement are good with plenty of opportunity to gain practical experience in their chosen field. They feel, perhaps justifiably, that they will not find competition for bigger jobs as keen as in the states, where more people are trying for them.

The third, and largest single group is

Golf course at Creole Petroleum Corporation's Caripito Camp in Eastern Venezuela.

Staff residence in Santa Barbara Camp, Venezuela.

that which wants simply to get into foreign service because the rates of pay are higher than at home. Actually they can expect more pay than they would receive for similar employment in the states, and they will find that in countries with an excessive cost of living index the company usually grants a living allowance which balances the excess.

Oil companies maintaining overseas organizations feel a definite sense of responsibility to the expatriate employe. This is expressed in the many employe benefits, and in their efforts to guide employes in acquiring the "feel" of a country. A dissatisfied employe is not only expensive but troublesome and a threat to the morale of the organization. Therefore, in taking foreign work, the worker may expect a good measure of compensating benefits. There is good pay, bonuses, good housing and recreational facilities, and each employe is given a 64-day vacation every two years with all traveling expenses for himself and his family to his home anywhere in the U. S. In Colombia and Venezuela each employe is entitled to a yearly bonus equivalent to a month's pay, with an additional sum paid in to a retirement fund. These benefits are expensive, but not as expensive as dissatisfied employes.

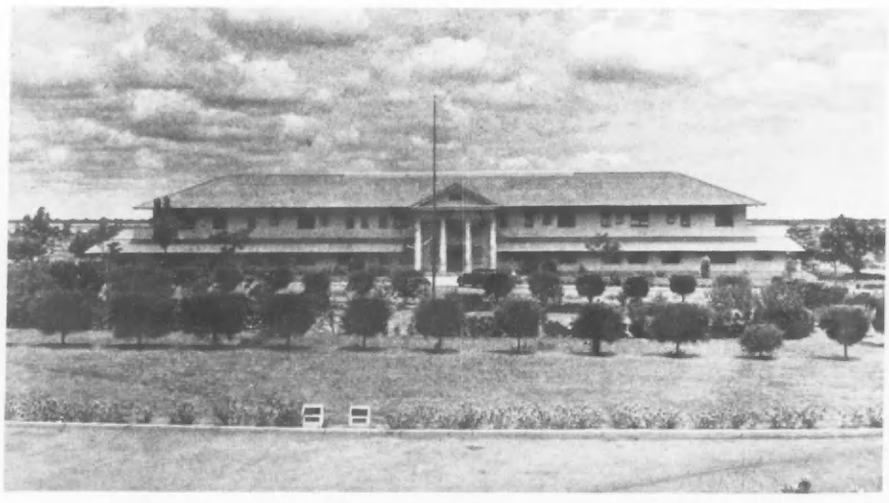
A considerable burden is placed on the men responsible for the screening of prospective employes. With the time and information at their command they can do little more than make an investigation into the ability of the man to do the job for which he is being selected. They realize that once hired, the company assumes a great deal of responsibility, and they hope that the man will in turn feel a certain measure of responsibility. It is almost never possible to determine from interviews alone whether a man has the inner stability necessary to adjust himself to an entirely different set of conditions, and will come through the initial shakedown period without experiencing too much frustration and discouragement.

Costly Investment

Failure on the part of the employe is felt as a failure on the part of the personnel recruitment staff. It is also felt keenly in another sense by the company. By the time a man reaches the job the company has a substantial cash investment in him, and the employe should feel a responsibility to return this investment in his value to the organization. One company has found that in the case of hiring men in Texas for work in Venezuela, which involves the shortest travel distance of almost any other foreign employment, they spend an average of $1500 in cash before the man starts work, and an additional $1000 to get him home if he doesn't stick. Employment expenses include transportation into headquarters such as at Houston and maintaining him at a hotel while all details of employment are completed. Meantime, a passport must be obtained and properly visaed; he must have the proper health examinations, vaccination, and innoculation before obtaining final clearance. He is then flown to Caracas or Maracaibo where he must be cared for until he can be taken to the point of assignment. In cases where they go through an indoctrination course the investment is correspondingly greater. The investment mentioned above does not include his salary, which is being paid from the time he signs up.

It has been found that many employes arrive overseas with the need for becoming conditioned to a different kind of life from that pictured in their minds. Many have been expecting a rough life among snakes and wild animals while living in crude camps. They are surprised to find the comfortable camps with three flavors of ice cream in the mess hall, and that air transportation is available to any operating point.

Speakers on the panel repeatedly emphasized the need for understanding and tolerance on the part of Americans in foreign countries. An interesting comparison was presented through suggesting an hypothetical case in which a group of foreigners would move into an area of the U. S. to take over completely the running of a major industry. Suppose the foreigners held all the top positions, rating higher salaries than were paid any Americans working for them, and banded together without learning the language or customs and with scant respect for our laws. They would doubtless consider themselves superior, and would rightfully earn the resentment of all Americans. In addition they would fur-



Base hospital in oil company camp, Venezuela.

Our 23 Years

of geophysical surveys and interpretations in fields throughout the world will be of inestimable value in mapping your course of future oil development.

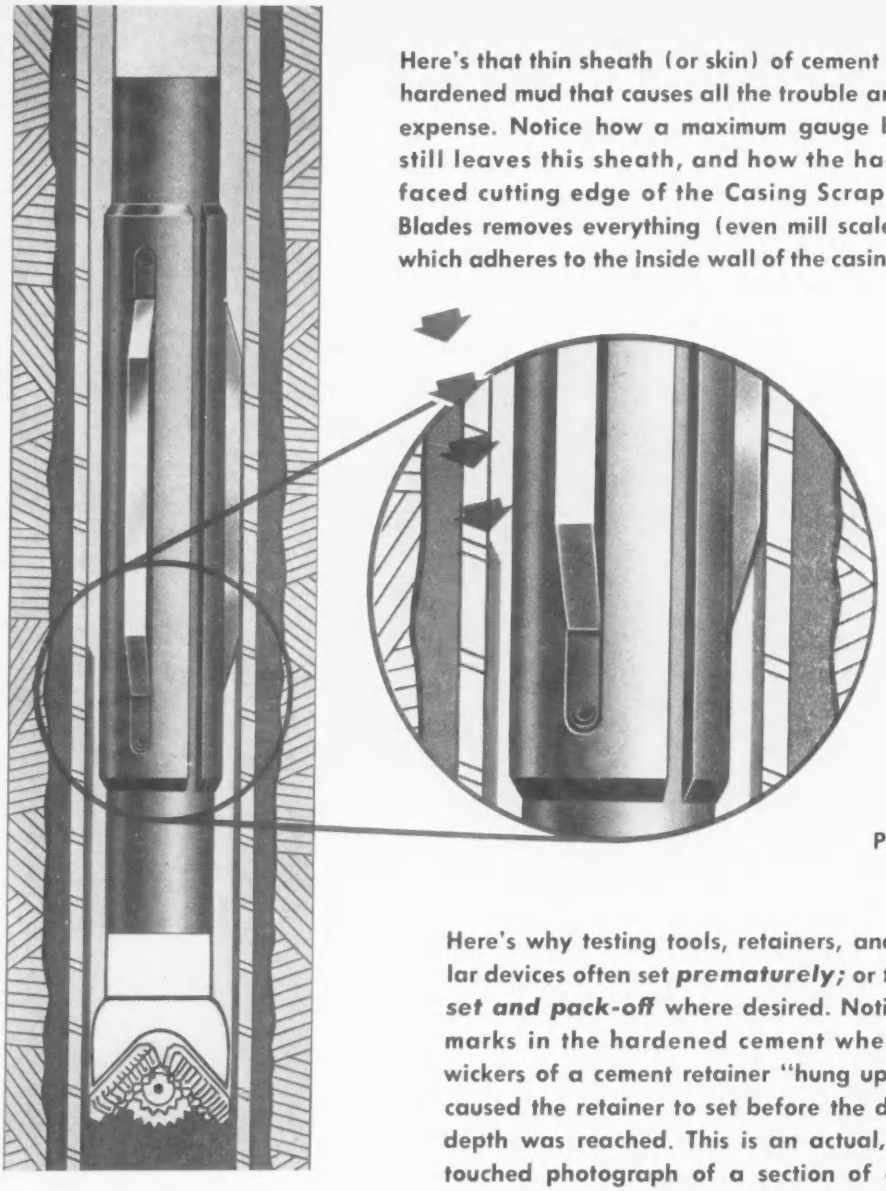
PETTY

GEOPHYSICAL ENGINEERING CO.

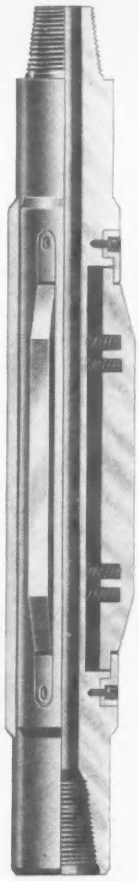
SEISMIC — MAGNETIC — GRAVITY SURVEYS

SAN ANTONIO, TEXAS, U. S. A.

EVEN 1/16 INCH OF HARDENED CEMENT CAN

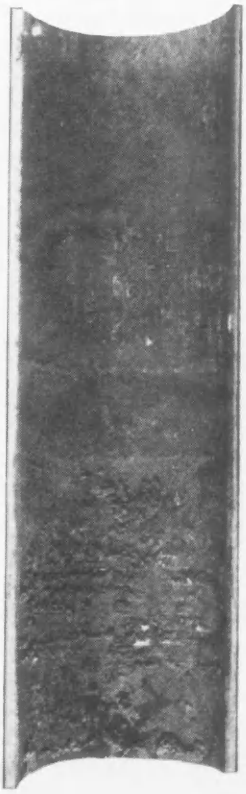


Here's that thin sheath (or skin) of cement or hardened mud that causes all the trouble and expense. Notice how a maximum gauge bit still leaves this sheath, and how the hard faced cutting edge of the Casing Scraper Blades removes everything (even mill scale) which adheres to the inside wall of the casing.



Baker Rotary Casing Scraper Product No. 620-B

Here's why testing tools, retainers, and similar devices often set ***prematurely;*** or ***fail to set and pack-off*** where desired. Notice the marks in the hardened cement where the wickers of a cement retainer "hung up" and caused the retainer to set before the desired depth was reached. This is an actual, unretouched photograph of a section of casing which was removed from a well, after having been drilled out with a maximum gauge bit.



Here's how burrs left around gun-shot holes are scraped away and are no longer a menace or a nuisance. The inside of the casing is left "clean as a hound's tooth" ready for ***immediate*** completion work; and in proper condition for remedial or work-over operations a ***year or ten years in the future.***

LEAVE YOUR CASING CLEAN AND SMOOTH BY

AN CAUSE PLENTY OF EXPENSE AND TROUBLE

THE BAKER ROTARY CASING SCRAPER (Product No. 620-B) removes cement, paraffin, hardened rotary mud, burrs from gun-shot holes, and all other obstructions adhering to or protruding from the inside walls of casing. It eliminates the sharp, rough obstructions which cut, tear and mutilate the rubber packing units on swabs, packers and testing tools. It removes the mud and cement which often cause the premature setting of devices having wickers or slips before the desired depth has been reached. It leaves the inside walls of your casing clean and smooth, so that tools having a packing member can seal off properly; and the wickers or slips on other devices having metal-to-metal contact with the casing can grip securely.

MANY ADVANTAGES

THE BAKER ROTARY CASING SCRAPER can be run on drill pipe while the rig is up and the rotary crew is still on hand, and usually is installed just above the bit when drilling out the cement shoe, — see illustration opposite. In event the casing was not scraped at the time the well was completed, and obstructions are found that interfere with work-over or remedial operations, The Baker Rotary Casing Scraper can be run on tubing and either rotated manually with tongs over limited areas, or an endless spinning rope can be used when several hundred feet of casing are to be scraped. The strong construction, the self-equalizing blades with long, hard-faced scraping edges, all combine to insure fast, safe, low-cost operation.

REMEMBER THIS

Only the BAKER ROTARY CASING SCRAPER (Product No. 620-B) is equipped with springs behind the blades to provide constant, uniform contact with the side walls of the casing. For removing gun-shot burrs, all springs are used; for removing paraffin and similar softer substances some of the springs are removed, as maximum pressure against the casing is not required. You do not depend upon hydraulic pump pressure to maintain scraping contact against the casing, and yet, the BAKER ROTARY CASING SCRAPER is easy to run in or out of the well, and always scrapes maximum footage before the blades are dulled.

Remember also that **your** crews can run the BAKER ROTARY CASING SCRAPER successfully. The low-cost rental charge for domestic service, or the reasonable cost when purchased for over-seas use, is extremely cheap insurance for positive knowledge that the "working surface" of your casing is left clean and smooth, free from dangerous obstructions which interfere with future operations.

HOW TO ORDER

FOR DOMESTIC RENTAL USE: Get in touch with the nearest Baker representative. Furnish him with the size, type and weight of casing which is to be scraped; also the size and type of drill pipe or tubing thread connections desired on the BAKER ROTARY CASING SCRAPER. Give him an idea about what kind of material is to be scraped off the inside of your casing, and about how many feet are to be scraped. Then leave the rest up to the Baker man — he will take good care of you.

FOR OVER-SEAS USE: Address inquiries to Baker Oil Tools, Inc., 11 West 42nd St., New York 18, N.Y. or Box 2274 Terminal Annex, Los Angeles 54, California or refer to Page 488 of the 1948 Baker (or Composite) Catalog for specifications and recommendations to select one or more BAKER ROTARY CASING SCRAPERS. Be prepared to leave the "working surface" of your casing in **every** well clean and smooth and ready for all future operations.

Y RUNNING A BAKER ROTARY CASING SCRAPER

nish us with the only standards by which we could judge the people of their entire nation.

In the earlier days of the petroleum industry abroad much the same set of conditions applied. Now the companies feel the responsibility of promoting better relations between expatriates and nationals. In some countries it has become a legal responsibility as well. In Venezuela, for instance, where the industry involves more personnel than any other foreign country, the law states that the total personnel of a company must be made up at least 75 percent of Venezuelan nationals. In addition it states that orders to workers must be given in Spanish. Immediately this imposes two conditions upon expatriates going to Venezuela. Since only a limited number are allowed, they should be not only well fitted personally for doing a job, but become part of management in that they must direct certain phases of operations and have the ability to impart their knowledge to others, and they should known or learn enough Spanish to give instruction and direction.

A little-stressed, but important consideration is the ability of a man to get along with his expatriate co-worker. They are much more closely associated with each other than they would be in the states. They and their families come together more on and off the job than at home, so the ability to get along is of prime importance.

Although a preference for single men will be found, companies are chiefly interested in competency, so more and more married men are being sent abroad. However it is apparent that here the problem is multiplied. There are two people who must be satisfied to live abroad, and therefore the companies recommend that a married man spend the first six months of his contract on the job before sending for his wife and family. He thus will have been able to familiarize himself with the situation and gain some idea of whether his wife would be happy there. If they go at the same time their problem is vastly more complicated. He is trying to get shaken down into a job at the same time she is trying to set up a household with the chances that neither knows enough of the language and customs. The delay in having the wife join her husband gives the company time to make living quarters available and gives the man time to adjust himself. Mistakes are expensive, since returning a family is so much more expensive than returning individuals.

In this connection, many companies sending a man whose family is to join him later like to have the entire family pass a rigid physical examination, since the health and well-being of any member of the family is as important as that of the employe himself. It is advisable to have this checkup prior to the employe's departure to avoid later disappointment should family members fail to qualify physically.

An Employe to Avoid

One individual the company tries to avoid is the one who wants to sign up for a single tour of duty. Although he is not obligated to work beyond his original two-year contract, the company wants an employe who desires to go into foreign service as a career. Too often the employe expects to make a large sum of money from one tour of duty, which is generally not the fact. He stands a much better chance over a period of several contracts, through reductions in income tax he has to pay, lower living costs provided by company policy, and decreased temptation to spend a lot of money. It is better for the company also since it is not continually breaking in new men on a job. The longer he stays, the better understanding he has of the habits and customs, and the better his relations becomes with the nationals of the country.

It has been pointed out that many who would like to go into foreign service with oil companies do not realize that there are many jobs abroad for others than trained technical personnel or skilled workers. The technical personnel is actually a comparatively small part of the group, and there are jobs of every descriptions for people who fit the qualifications, and there are many jobs to which lack of experience is no barrier.

Although most of the discussion concerned men in foreign service, it was pointed out that many places are being filled by women. From the beginning the companies have used women nurses, hospital technicians and school teachers, and for some time women have been sent abroad to fill special secretarial posts. Companies are to an increasing extent relaxing their former policies of using men in all positions which can be filled by men, and today there are many clerical and stenographic jobs available to American women. This has not yet become a universal practice, however.

For the most part it will be found that companies do everything possible to provide for the health and well-being of their people, physical and otherwise. Hospitals have been established where they can receive expert medical and surgical attention without expense to themselves. Schools are provided and staffed with American teachers so that education is available for children through the elementary grades. Camps are actually company-built cities with modern houses, sanitation facilities, water-purification equipment, comissaries at which almost any known brand of foodstuffs is available at rigidly controlled cost, refrigeration plants, and recreational facilities. Every camp has its clubs with libraries, bar, dance facilities, movie equipment with regular showings of recent films, pool and billiard tables, tennis courts and many camps have excellent golf courses and swimming pools. Almost every established headquarters camp has excellent bowling alleys and regular bowling leagues.

Many expatriates fail at first to sense the extent to which companies assume responsibility for the employe's health, comfort and happiness. It is to be hoped that the expatriate employe will sense his own responsibility to the company and to manifest it in conduct reflecting credit on the American people and American enterprise.

Company-operated commissary in Venezuela.

STOKVIS---LOOK! AND LISTEN!

ROLO WELLCHECKERS

PERMANENT
SKID MOUNTED
TRAILER MOUNTED

Ten No. 3 Rolo Wellcheckers destined for foreign fields.

Maximum capacity 2880 BPD; 3000 MCF per day.

Code Labeled — API - ASME

Wellchecker Size and Capacity Tabulation

Type	Maximum Oil BPD	Maximum Gas MCF	W.P. Lbs.	Separator
ST-1*	600	60	125	16" x 50" Vertical
ST-3*	1,000	500	"	24" x 66" "
1	720	3,000	"	24" x 66" "
2	1,440	3,000	"	24" x 66" "
3	2,880	3,000	"	24" x 66" "
IV-3084	2,880	5,000	"	30" x 8'4" "
IV-3010	4,600	6,000	"	30" x 10' "
1H-2406	800	3,000	"	24" x 6' Horizontal
1H-3607	1,440	5,000	"	36" x 7' "
1H-3612	3,000	12,000	"	36" x 12' "
5V-2456	1,440	6,000	500	24" x 66" Vertical
5V-3084	2,880	8,000	"	30" x 8'4" "
5V-3011	4,400	14,000	"	30" x 11' "
5H-3607	1,440	10,000	"	36" x 7' Horizontal
5H-3012	2,880	16,000	"	30" x 12' "
5H-3016	4,400	20,000	"	30" x 16' "

*Includes Internal Float Gas Valve.

ROLO WELLCHECKER includes separator, pop valve, gauge glass, pressure gauge, water knockout; gas run, gas valve, orifice fitting or flange, orifice meter; oil line, strainer, oil valve, oil meter with sampler, meter by-passes; check and plug valves, fittings, piped up ready for operation.

ROLO WELLCHECKER SEPARATOR ONLY. Completely piped up ready for operation includes oil valve, pop off, gauge glass, pressure gauge, valves and fittings. Gas valve, orifice fitting or flange, gas run and other controls, optional.

When specifying please state: type of crude; min. and max. rate of flow (hourly if possible); gas oil ratio.

EXPORT REPRESENTATIVES

R. S. STOKVIS & SONS, INC.

17 Battery Place

NEW YORK 4, N. Y.

Established 1844

Saudi Arabia's Expanding Importance Calls for New Investment

In the wasteland of Saudi Arabia, the paths of camel caravans and the 30-inch Trans-Arabian oil pipe line frequently cross. Ring girders (center) which hold sections of the pipe together, are strung but not yet bolted.

THE producing potentialities of the fields of Saudi Arabia are expanding at a rate challenging the imagination. The Dammam field, site of the original discovery of oil in the locality, has leveled off at a producing rate of roughly 100,000 barrels a day. This is a substantial producing capacity, yet the field is of secondary importance to the newer Abqaiq structure, and more, the discovery of oil at Ain Dar, 27 miles west of Abqaiq, opens still broader possibilities.

World's Best Producer

Abqaiq is producing 375,000 barrels a day. At that rate it is yielding more than any other field in the world, outstripping even the Lagunillas field of Venezuela and the famed East Texas field in Texas, each of which produces in excess of 300,000 barrels daily. Most significant is the fact that, although there have now been 44 wells drilled in the field, only 25 of them have been connected into the regular production system, so that the entire production is coming from these 25 wells, an average of 15,000 barrels daily per well.

The Ain Dar field, opened several months ago, has yet to be defined. The single well completed is in the same Arab limestone pay, and showed 250 feet of section, about 30 feet more than the Abqaiq field. A second well is being drilled 18,000 feet south, and is actually running higher on formations than the discovery. Preparations are now under way to drill another wildcat more than 100 miles to the south, on the same continuous line of folding, and conceivably on the same structure.

These developments serve only to emphasize that the vast reserves already proved may be only a portion of those yet to be found. Performance of producing areas to date indicate that these reserves may be reduced to actual production by drilling comparatively few wells, although the geographical location and necessary transportation facilities will force huge capital investment.

The Arabian American Oil Company and the Trans-Arabian Pipe Line Company are planning capital expenditures of $520 million to expand operations during the period 1948-1953, it was disclosed by W. F. Moore and B. E. Hull, respective presidents of the two companies.

The expenditures, both officials said, are in line with the companies' conviction that the development of Middle East oil production and transportation facilities is vital to the world economy. The division of investment shows that $200 million has been planned for TAPline, and $320 million for Aramco's producing and supporting facilities.

Concerning the present status of the TAPline project for a pipe line from the Persian Gulf to the Mediterranean, Hull said:

"The vast quantity of oil needed for the economic recovery of Europe under the Marshall Plan can best be supplied if adequate means of transporting the oil from the Middle East to the Mediterranean are provided. About 145 miles of pipe line have been laid and there is almost 100 miles more of pipe in Saudi Arabia being installed at the rate of about five miles a week."

$70 Million Spent

Hull revealed that about $70 million has been spent on the project to date. The initial stage, he said, should be completed in 1950, providing a capacity of 300,000 barrels a day. The 1067-mile pipe line will eliminate the 7200-mile round-trip tanker voyage around the Arabian Peninsula and through the Suez Canal to the Mediterranean for the oil destined for Europe and other points west of Suez.

To transport this quantity of oil by water to the Mediterranean would require 102 of the T-2 tankers, Hull said. The completed 500,000 barrel-a-day pipe line would use 200,400 less tons of steel than would be required to construct 102 T-2 tankers with gathering lines and port facilities necessary to load the ships at Ras Tanura, Hull estimates.

Aramco resumed its pipe rolling schedule October 28, and is due to receive 43,000 tons of pipe ready for

■ CONTINUED ON PAGE 230

Search for Oil in Ontario

Offshore wells in Lake Erie near Port Alma. These wells are produced principally for gas.

By ZOE PAULINE TROTTER

NEW Oil Fields for Old might be the title of the saga of Canada's oldest oil field area—the extensive producing region of southwestern Ontario.

Coincident with the search for oil in Western Canada which culminated in the dramatic discovery of a new field at Leduc in central Alberta, Imperial Oil, Ltd., undertook a resurvey of southwestern Ontario where oil fields have been producing without interruption since 1861, although in unspectacular quantities. One of the main objectives of the re-study was to develop "second crop" oil fields in the proved areas. Instead, the geologists came up with two new producing fields and the possibility of still more.

In February, 1946, Imperial discovered the new Becher oil and gas field near Wallaceburg in which production was obtained from the Salina and Guelph formations at a depth of about 1850 feet. In August, 1947, the company discovered gas in the Kimball area, 12 miles southeast of Sarnia and since then seven productive gas wells have been completed in this field.

Curiously enough, the discovery of these two new fields was a surprise result from the survey begun with a totally different goal. What the geologists had in mind was the possible discovery of producing horizons at lower levels in the old, proved fields, a condition which had been found in Illinois a few years previously when new wells drilled to lower formations proved productive.

Although recent impressive discoveries in the Leduc field and announcements of the company's intention of spending $80 million in the search for oil in Alberta have somewhat overshadowed these smaller developments in the old Ontario fields, in the public mind at least, none the less the Ontario discoveries are of considerable significance. The two recently discovered fields known as Becher oil and gas field and Kimball gas field now are in production and the company's search for other Ontario fields is being continued.

Early Efforts

Historical records are not too clear as to the exact date of the discovery of oil in Ontario. It is positively known, however, that prior to the discovery of the first oil well in North America by Col. E. L. Drake at Titusville, Penn., on August 23, 1859, an American, J. Williams, opened a small oil refinery in Hamilton, Ontario. Williams operated with seepage oil from the gum beds of Essex country. There is an unconfirmed story among oldtimers in the Ontario fields that Williams dug the first oil well in North America with a spade. It is known definitely that following the Drake discovery in Pennsylvania there was intense activity at Oil Springs, Ontario, in 1859; at Petrolia in 1860, and at Bothwell in 1861. Actual discovery dates for the three original oil fields are: Oil Springs, 1861; Petrolia, 1865, and Bothwell, 1862. Oil was found quite close to the surface and it was not until much later that deeper holes were drilled.

In order to appreciate the magnitude of the task of attempting an appraisal of the future possibilities of Ontario it is important to understand that in the southwestern part of the province practically all geological deductions must be

made from the study of subsurface information. Therefore, before a reappraisal of the future oil possibilities of this territory could be made it was necessary to examine hundreds of sets of well cuttings and to study and attempt to reinterpret about 4000 drillers' logs obtained from numerous sources.

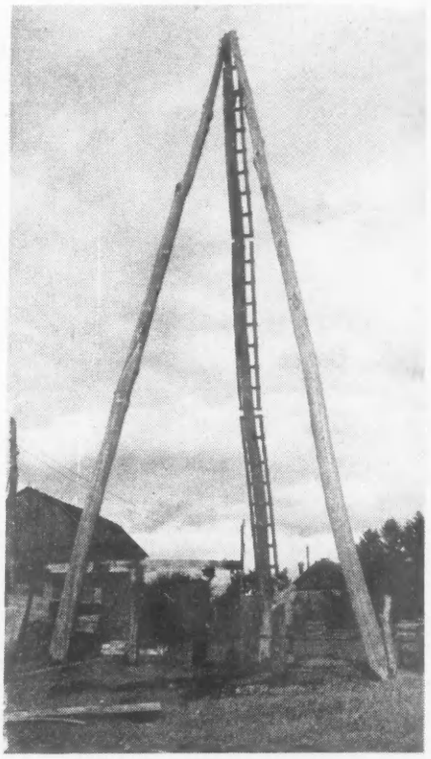
Cable tools always have been used in Ontario where the chert in the formations is hard on rotary bits. In some areas also there is considerable gypsum in the formations which has a tendency to swell and bind rotary tools. Also the Ontario field contains a number of salt beds. These dissolve out in the rotary drilling method and circulation is lost. Depreciation on a rotary drill runs around $200 per day while depreciation on cable tools is as low as $50 per day. Although rotary drilling generally is a much faster method, the modern spudders used by some contractors now drilling Ontario's wells make excellent progress and are a far cry from the old three-pole derricks once so familiar a sight on the southern Ontario landscape.

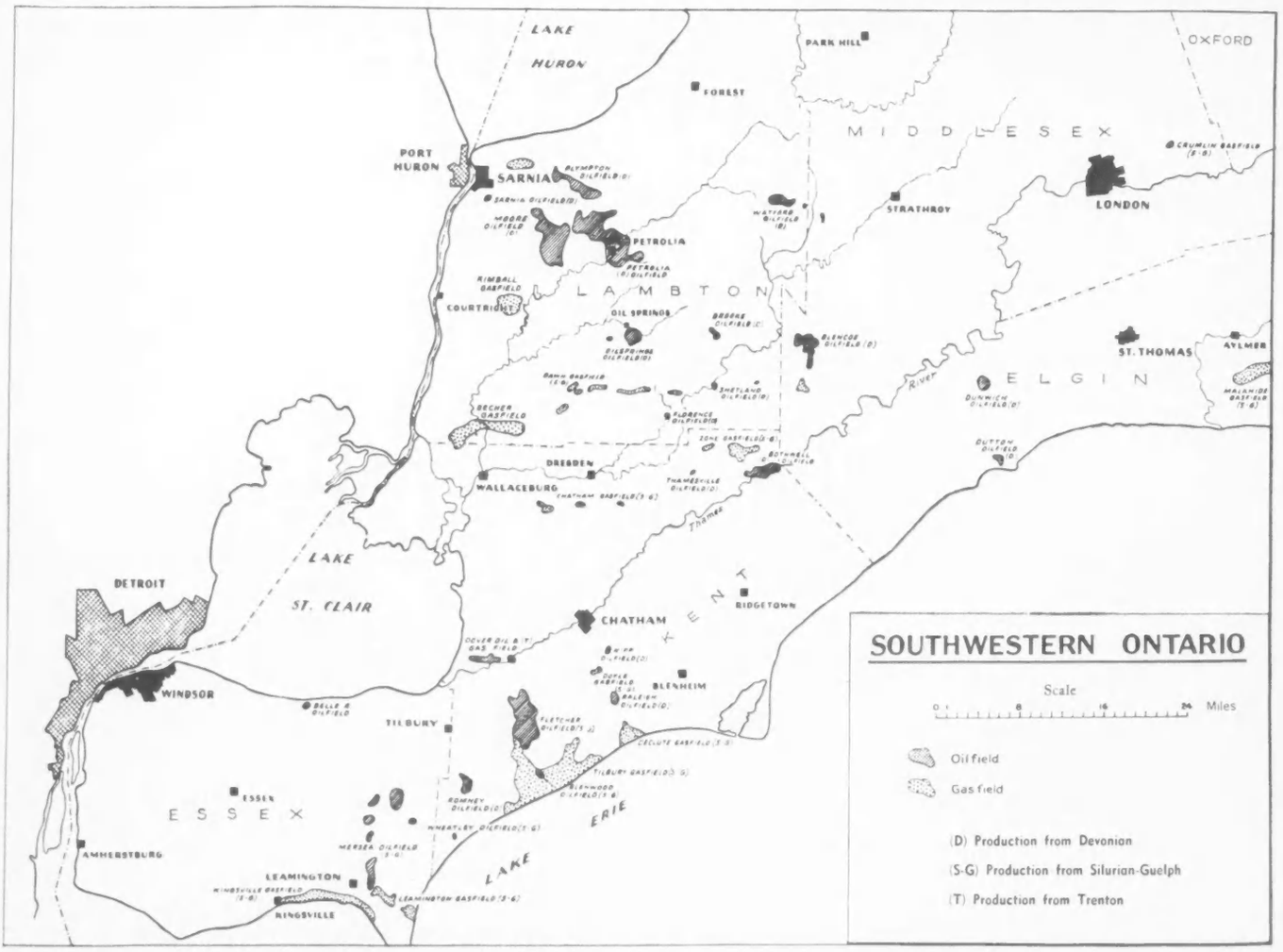
In the older fields of Ontario most of the oil was found at relatively shallow depths. The results of the recent exploratory drilling, however, give geologists hope that considerable oil may be found in the underlying formations. The restudy showed that many promising areas were hitherto untouched and that certain districts, formerly considered unfavorable, are promising for testing the possibilities of the lower formations.

Since its inception in 1862 the Petrolia field has produced 15 million barrels of oil. Oil Springs has produced between 8 million and 9 million barrels and the Bothwell field has produced 3½ million barrels. There are a number of other, smaller fields, unimportant in themselves, that add a modest figure to the production totals of the more important fields. All of these produce from the Devonian at 350 to 450 feet.

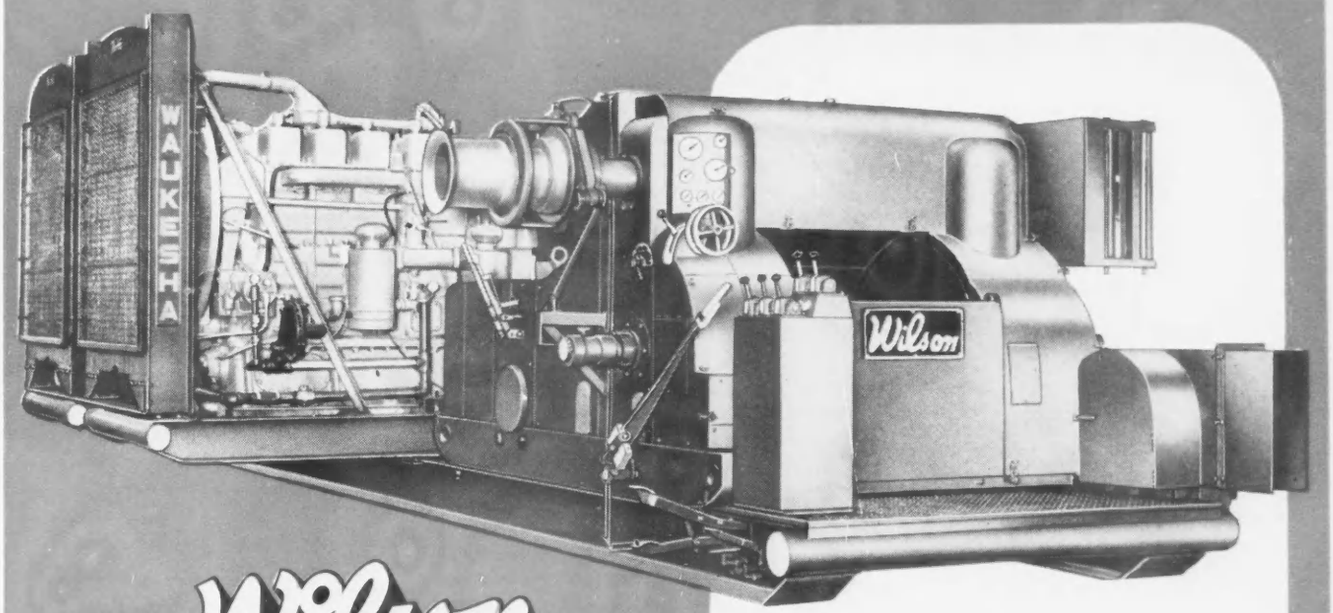
While several important gas fields obtain their production from the Salina-Guelph formation of the Silurian age, only two fields have yielded important quantities of oil: the Mersea in Essex county, with a production to date of approximately ½ million barrels, produced at around 1,000 feet, and the Fletcher field in Raleigh Township, Kent County, which has produced 1½ million barrels at slightly greater depths. The Dover oil and gas field in Kent county produced from the Trenton at from 3000 to 4000 feet. Very few exploratory wells—

Typical well in stripper area in Western Ontario. Here oil and water are collected in a wooden cistern and periodically drained.





The Most Adaptable of Drilling Rigs



Wilson GIANT RIG

Now available with new ROADMASTER Compound that makes it possible to transport the drawworks, transmission, engines, compound and pump drive shaft *all in one single load.*

Overall width at end of compound shafts with NKU Waukesha engines *under 11 feet.* With General Motors Twin 6-71 and Le Roi V-8 engines 10' 6". Special rotary table drive can be furnished to keep entire rig within above dimensions by removing catheads.

The Wilson Giant Rig is the only rig in its capacity class rated to take either 2 LRO Waukesha or V-12 Le Roi engines, or 3 LI-600 Cummins, V-8 Le Roi or NKU Waukesha engines. Why accept less?

Wilson
MANUFACTURING CO., Inc.
WICHITA FALLS, TEXAS

Pacific Coast Distributor—POWER RIG and EQUIPMENT CO—Los Angeles, California. *Export Agents*—GUY E. DANIELS—30 Rockefeller Plaza—New York City. LANGLEY Y CIA, Corrientes 1115, Buenos Aires, Argentina—TA-35 Libertad 9535.

probably not more than 75 all told—have been drilled in the Trenton in Ontario.

In Michigan, where the sequence of formation is similar to Ontario, there also have been very few wells drilled below the Devonian and it is possible that production may be found in that state in the underlying formations.

To date, Ontario's total production amounts to approximately 30 million barrels of oil. At Oil Springs, oldest of the Ontario fields, the yield per acre is more than 9000 barrels. This is greater than ultimately will be recovered from Alberta's famous Turner Valley field.

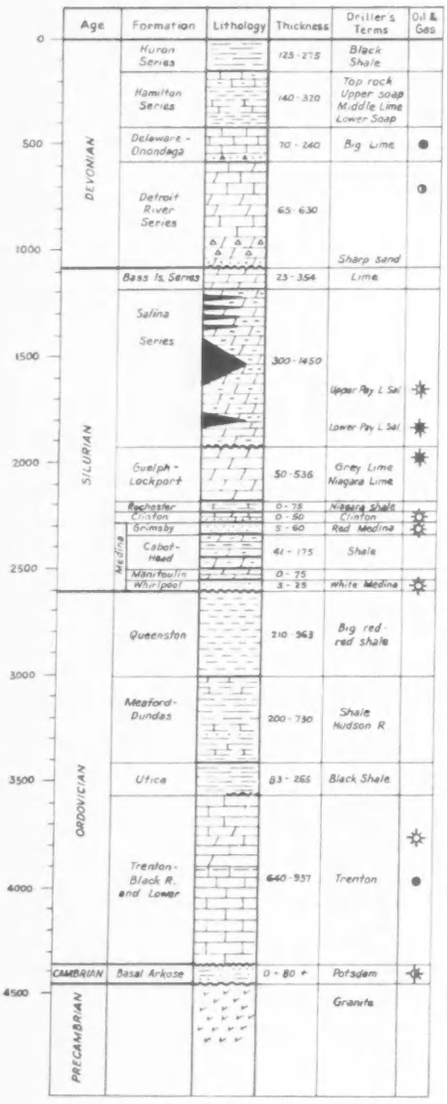
Ontario has produced 385,000,000-thousand cubic feet of gas since the first wells were brought in. This has a value of about $130 million. In the entire Southwestern Ontario area, more than 18,000 wells have been drilled.

With this picture in the background, Imperial geologists began their collection of old records and painstaking study in 1941. It was not until 1945 that the company began leasing rights in what the geologists hoped were promising areas. Actual drilling was commenced in July, 1945.

In the three years since this revival program began the company has discovered two new fields. The first of these is the Becher gas and oil field, three or four miles north of Wallaceburg, where the first well was completed in February, 1946. Production was obtained in the Salina-Guelph formation of the Silurian age. This field has been delivering between three and four million cubic feet of gas per day during the past winter and its potential production of oil is stated by Imperial officials to be about 200 barrels per day.

The Kimball field was discovered in August, 1947. It is 12 or 14 miles south of Sarnia. So far the Kimball field contains five gas wells which have been delivering 1½ million cubic feet per day. Mechanical difficulties forced the company to abandon the first well in which it got a showing of oil. At present Kimball is only a gas field, but in view of the good showing of oil in the first well it is possible that some oil may be found.

Glancing back over the practical results of Imperial's careful collection and restudy of old records, it becomes apparent that there are a number of promising areas in Ontario which so far have been disregarded by geological surveys and untouched by drilling tools. Obviously, it is much too soon to assess the over-all picture as the re-survey is not yet completed. Yet old time drillers are jubilant over the results achieved and even the most conservative of Imperial Oil officials admit that, "it seems likely that further new discoveries will be made in the province."



Generalized columnar section, Southwestern Ontario.

Saudi Arabia's Expanding Importance

■ CONTINUED FROM PAGE 226

shipment to Suadi Arabia by January 1. Further pipe shipments have been held up by the company for six months due to failure of the Commerce Department's Office of International Trade to approve the export license.

Aramco also has let a $5 million contract with a British concern for construction of a causeway and pier carrying a broad gauge railroad seven miles long into the Persian Gulf. The pier will be used for berthing ships which are supplying new oil fields now being developed around Dharhan. All plant equipment for this job will come from Britain, and the work gets under way immediately.

Steel requirements for the whole pipe line project include 365,000 tons as against 565,000 tons that would be needed for the construction of the tanker fleet, says Hull. To date, 62,630 tons of steel have been shipped to Saudi Arabia covering steel for tanks, engines, pumps and enlarged terminal facilities necessary to reach the 500,000 barrel a day production goal set for the immediate future.

Moore, discussing the Aramco project, said that present production was in excess of 450,000 barrels per day and that production by 1951 is expected to exceed 700,000 barrels per day. Moore also said that oil ranks second only to food in importance to the European recovery program and that if all of the Marshall Plan oil had to come from the Western Hemisphere rationing in the U. S. would be inescapable.

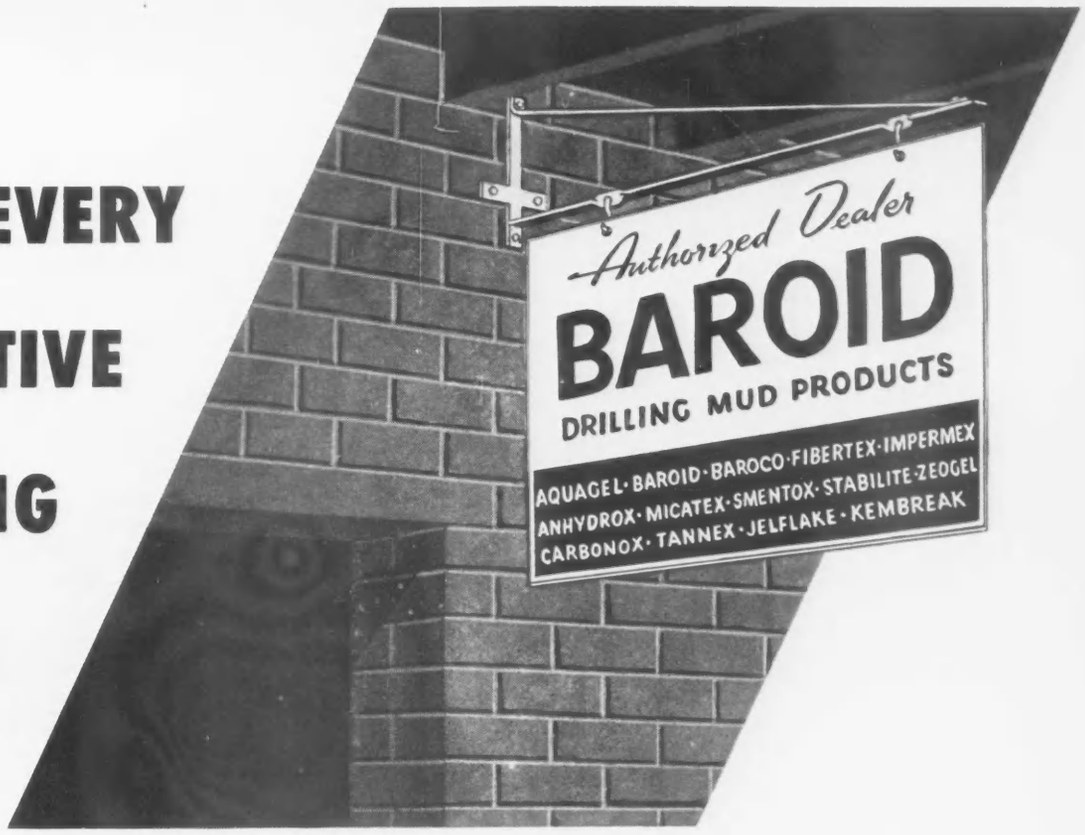
In past years large volumes of oil have been shipped to Europe from the U. S. and South America, providing a strain upon the resources of the Western Hemisphere. American oil reserves are being depleted nearly six times as rapidly as those of the Middle East, which has greater reserves than the U. S. by about 50 percent. Now, more and more of Europe's needs can be filled from the Middle East, meaning retention of American oil at home and longer life for American reserves.

The U. S. now is importing 500,000 barrels of oil per day from South America and about 100,000 barrels daily from the Middle East to supplement its own production of about 5½ million barrels. As Middle East oil increases its flow to Europe, the Western Hemisphere can stop the 600,000 barrels per day now going across the ocean from this side and use the oil to meet its own increasing requirements.

Aramco and other oil companies operating in the Middle East are in effect financing a "Junior Marshall Plan" for that area. The investments for prospecting and development of new fields as well as existing ones, construction of housing, hospitals, schools, pipe lines and refineries, are coming from private sources. These investments will total about $1½ billion during the next five years.

Whereas the Marshall Plan for Europe assists in the economy of 16 countries, with a per capita benefit of $16, the oil development in the Middle East will benefit ten countries to the extent of $6 to $9 per inhabitant, without cost to the American taxpayer. In fact, the taxpayer will also benefit because American companies will be paying substantial income taxes to the U. S. government.

IN EVERY ACTIVE DRILLING AREA


Authorized Dealer
BAROID
DRILLING MUD PRODUCTS
AQUAGEL · BAROID · BAROCO · FIBERTEX · IMPERMEX
ANHYDROX · MICATEX · SMENTOX · STABILITE · ZEOGEL
CARBONOX · TANNEX · JELFLAKE · KEMBREAK

. . . Over 500 Strategic Locations

Located in the areas best suited to serve the industry requirements, this huge network of Baroid distributors is your assurance of ready, efficient service when and where you need it!

Adequate warehousing facilities, complete stocks and prompt deliveries are additional features that contribute to the growing demand for Baroid Drilling Mud Products.

Send FOR THIS FREE DISTRIBUTOR LIST. IT IS YOUR GUIDE TO BETTER DRILLING MUD PRODUCTS.

Address requests to:
ADV. DEPT. BAROID SALES DIVISION
NATIONAL LEAD COMPANY
830 DUCOMMUN STREET
LOS ANGELES, CALIFORNIA

PATENT LICENSES, unrestricted as to sources of supply of materials, but on royalty bases, will be granted to responsible oil companies and others desiring to practice the subject matter of any and/or all of United States Patents Numbers, 2,041,086; 2,044,758; 2,064,936; 2,094,316; 2,119,829; 2,294,877; 2,387,694; 2,393,165; 2,393,173; 2,417,307 and further improvements thereof. Applications for licenses should be made to Los Angeles office.

BAROID SALES DIVISION
NATIONAL LEAD COMPANY
LOS ANGELES 12 • TULSA 3 • HOUSTON 2

4 Million Acres Taken in

Alberta Leasing Program

By ROY E. LEIGH

A GROUP of independent operators representing both Canadian and American capital have secured oil exploration reservations totaling 4 million acres in northern Alberta for an aggressive exploratory campaign, and several of the major oil operators have recently taken additional acreage in the area to bring the total now under Crown reservation to more than 10 million acres. The total obtained by all operators in early September and late August amounted to more than 9½ million acres.

The play in the northern part of the province now covers an area extending from Edmonton northward through Athabaska for more than 200 miles to a point near Mackay on the Athabaska River, and in a northwesterly direction past Lesser Slave Lake and along the line of the Northern Alberta Railway to the Peace River country, about 300 miles from Edmonton. Most of the new independent combine's properties will lie in the area directly north of Edmonton, while that of Imperial Oil Company, Ltd., Stanolind Oil and Gas Company, and others are for the most part to the northwest.

Leasing Rules

The 4 million acres to be prospected by the independent group are held by a group of about 20 separate companies, since the regulations provide that no single company may hold more than two Crown reservations in Alberta totaling 200,000 acres. The new companies were created for the purpose of obtaining the acreage in 40 separate 100,000-acre tracts. The greater part of the territory covered by the reservations lies in the shape of a huge oval which follows northward along both sides of the Athabaska River and back along a branch of the Northern Alberta Railway.

The new companies all have the same management, the officers being associated with some of the better known Alberta independent operators. No official statements have been made as to operating plans, but it is understood that the 40 reservations will be explored with the backing of important independent financial and oil groups from Canada, New York, Pennsylvania, Texas and California. Deposits totaling $½ million have been placed with the government to guarantee performance of prospecting commitments, in addition to $10,000 paid in reservation fees. According to present reports, Pacific Petroleums, Ltd., a leading Canadian independent will be the operating medium for the group's program. Dr. T. A. Link, formerly chief geologist for Imperial Oil will direct the geological investigation on a consulting basis, and United Geophysical Company is expected to handle the geophysical work. Two gravity meter crews will begin work soon, to be followed by seismograph and perhaps core or structure drilling.

Imperial Oil has acquired 1,175,000 acres in Crown reservations within recent weeks. The company has been one of the original firms to become interested in northern Alberta, and now holds nearly 2½ million acres for exploration in the section north and northwest of Edmonton, A substantial part of its holdings lie to the northwest toward the Peace River country, where gas production is already being developed by Peace River Natural Gas Company, Ltd., and where geological reconnaissance work has been carried out by several companies. Imperial has also used subsidiaries in acquiring its acreage. One well, Imperial's Spirit River 1, is now drilling below 3620 feet, on a tract previously taken.

Others interested in the general area are British American Oil Company, which has nearly 600,000 acres under reservation and which is actively carrying on reflection seismograph work, and Stanolind, which recently added another 400,000 acres to its reservation total, River Oil Company, and Lake Oil Company, two Stanolind subsidiaries having recently acquired 200,000 acres each in the area 20 to 30 miles north of Athabaska.

Meanwhile, Hudson's Bay Oil and Gas Company, Ltd., has taken exploratory reservations in the Peace River country on approximately 400,000 acres to enter the north and northwest Alberta play. Here, as on other recently acquired acreage a geophysical program is planned as soon as equipment is available for moving in. The firm is owned by Continental Oil Company and the Hudson's Bay Company, the same famous British company so active in trading in the northern territories since the latter part of the 17th century.

Gulf Enters Play

Canadian Gulf Oil Company has now joined the ranks of those companies going into the Peace River country by taking up seven new Crown reservations of 100,000 acres each. Some of the acreage lies north and northeast of Edmonton, some is northwest of Edmonton along the Northern Alberta Railway, while 200,000 acres are in the Peace River area itself, near the location of Imperial's drilling wildcat.

Additional interest is created in the area with recent reports that Peace River Natural Gas Company has completed Alberta 2 with an indicated potential of 23,800,000 cubic feet of gas daily at a depth of only 2250 feet. The gas is coming from the Peace River sand and is apparently the same or is allied to the sand in which Pacific Petroleums, Ltd., has completed several gas wells on the British Columbia side of the provincial border. Pacific Petroleum holds a substantial interest in the Peace River Natural Gas Company. In connection with associated companies, it is attempting to develop a sufficient gas potential to justify building a large-volume gas transmission line to the consuming centers on the Pacific Coast side at Vancouver and Victoria.

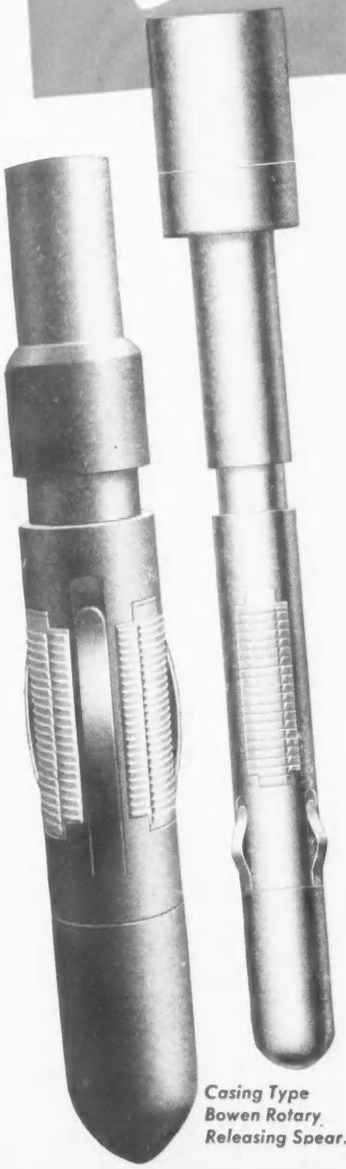
Wells already drilled, plus those now in progress, should soon furnish enough information for a basis on which to estimate whether or not a pipe line should be started. Construction of a pipe line to the area would encourage development on other blocks, since an outlet would then be provided for any gas found while the search for oil continues.

If it's a tough spear job... *Call in* BOWEN!

WHETHER YOUR FISH is drill pipe, tubing or casing, a Bowen Rotary Releasing Spear gives you faster, safer and more dependable recovery. Years of *successful* fishing experience throughout the world has developed the Bowen Rotary Releasing Spear to provide...

7 OUTSTANDING ADVANTAGES FOR DEPENDABLE SPEARING OPERATIONS...

1. **EXTRA LARGE GRIPPING SURFACE** in the now famous Du-all Slips. These Slips reduce possibility of fish distortion—even under heavy, repeated jarring!
2. **WICKERS FOR BACK OFF AND HOLDING** are in the design of each Slip—besides the regular number of wickers for pulling, there is one vertical wicker for holding and one vertical wicker for backing off!
3. **INSTANT RELEASE AT FRACTIONAL TURN** permits raising or lowering the fishing string to best engagement position—and re-engagement of Spear to fish again requires only a fractional turn!
4. **FREE ROTATION RIGHT OR LEFT** of the fishing string is possible by integral keys on the Spear body which stop the slips in a set or released position, whichever is desired at any given time.
5. **CIRCULATION IS MAINTAINED** by simple installation of a Bowen Pack-Off Attachment on the lower portion of the Bowen Rotary Releasing Spear—after fish is securely engaged, full circulation can be maintained through the fish.
6. **PRE-ENGAGEMENT FISH CONDITIONING** to assure positive internal engagement is easily accomplished by attachment of a Bowen Mill Type Nut—right rotation both mills the fish and drills out sand or corrosion.
7. **POSITIVE CONTACT IN LARGE HOLE OPERATIONS** is assured by the design of Skirts and Guides available for all Bowen Rotary Releasing Spears—good insurance for proper alignment and easy entrance.



Casing Type Bowen Rotary Releasing Spear.

Tubing and Drill Pipe Type Bowen Rotary Releasing Spear.

There is a Bowen Rotary Releasing Spear designed specifically for *your* fish when it is to be engaged internally. Available from Bowen stores in your territory—sold outright for export only.

SR BOWEN CO

MAIN OFFICE AND PLANT:
11008 SOUTH NORWALK BOULEVARD
SANTA FE SPRINGS, CALIFORNIA
EXPORT OFFICE:
30 ROCKEFELLER PLAZA
NEW YORK CITY, NEW YORK
EXPORT REPRESENTATIVE: VAL. R. WITTICH, JR.

Standard and Socony to Get Interest in Aramco

By HENRY OZANNE
Staff Writer

STANDARD Oil Company (N. J.) and Socony-Vacuum Oil Company, Inc., will acquire early in December a combined 40 percent stock interest in the Arabian American Oil Company, thus opening to two more American companies a participation in the rich oil pools of Saudi Arabia.

The purchase arrangement, which has been pending 18 months, will be finalized following the recent settlement of two legal actions involving Jersey Standard and Socony-Vacuum as partners in Iraq Petroleum Company, another Middle East oil enterprise. IPC is an international crude producing company owned by the British Anglo-Iranian subsidiary, D'Arcy Exploration Company; by the Dutch Shell subsidiary, Anglo-Saxon Petroleum Company; by the French Compagnie Francaise des Petroles; and by the American Near East Development Corporation, a wholly-owned joint subsidiary of Jersey Standard and Socony-Vacuum. These four partners participate in IPC to the extent of 23.75 percent each, while a remaining 5 percent of the company is owned by C. S. Gulbenkian through his corporate Participations and Investments, Ltd. The legal dispute among the IPC partners has been settled out of court in an understanding embodying the following terms:

Restrictions Annulled

1. The restrictive features of the IPC contract (the "Red Line Agreement") have been eliminated. The original 1928 IPC contract prohibited any one of the five partners from production operations, other than for the account of the others, in lands of the old Turkish Empire, and these "forbidden areas" were circumscribed on a map by a red line—whence the name of the restrictive clause. Therefore, when in January, 1947, Jersey and Socony announced their intention of buying into Arabian American Oil Company (Aramco), Compagnie Francaise and Gulbenkian sued to restrain the two American concerns from this action, charging that it violated the "Red Line Agreement" of the IPC contract to which all were parties. Jersey and Socony contended that the war had invalidated the contract and hence they were free to associate with Aramco. Action was instituted in the British courts to adjudicate the issue, but was dropped when the out-of-court settlement was reached. This settlement eliminates the restrictive clauses hampering Jersey's and Socony's action and allows the two American companies to acquire stock interest in Aramco while remaining partners in IPC.

2. Each of the five IPC partners formerly was entitled to crude from the company's production only in proportion to its stock interest. Under the new settlement, each shareholder may obtain from IPC operations, "on equitable terms," crude in quantities "based on its stated requirements rather than on its proportionate stock interest." This action was taken to placate the French who are solely dependent for Middle East crude on their share in IPC production.

3. Because Gulbenkian, the fifth IPC partner, has no refining or marketing facilities, provision is made for the purchase of his share of oil by the other four partners. Also "problems pertaining to currency payments, which have arisen out of exchange controls recently instituted in so many countries, have also been settled harmoniously." It is understood that Gulbenkian is granted the right to buy extra crude, over and above his 5 percent interest, at a price midway between production cost and market price, and that his sales of that crude are protected in U. S. dollars against British currency decline.

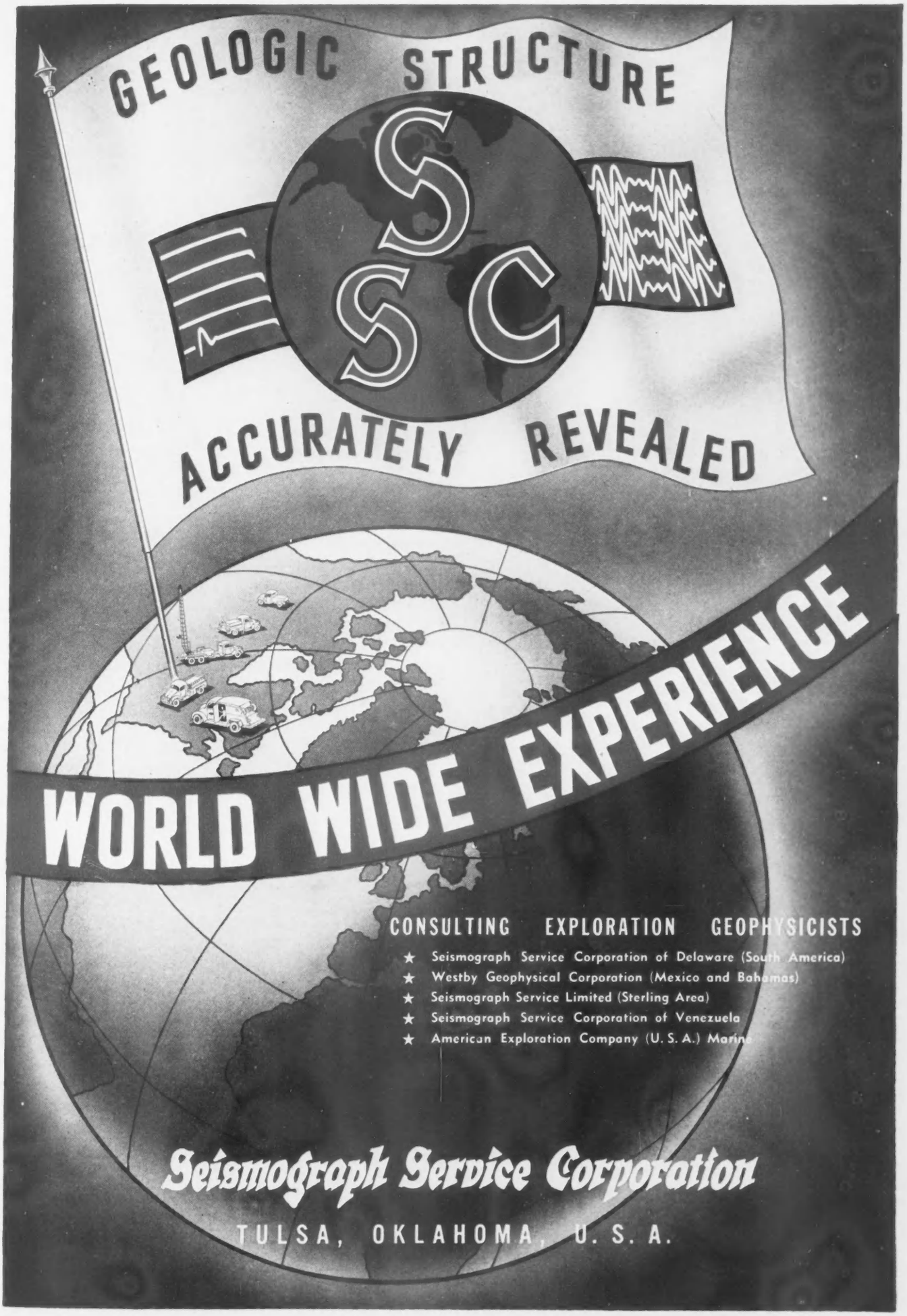
4. IPC is to expand production as rapidly as possible and to the extent economically feasible. This is in accordance with the wish of both Gulbenkian and the French to acquire a greater off-take of oil, Gulbenkian for purposes of converting the crude to cash; the French as a source of supply for badly-needed petroleum products.

5. IPC definitely commits itself to the construction of a 30-inch pipe line from the Kirkuk fields to the Eastern Mediterranean, the line to terminate in the vicinity of Latakia, Syria. This line has been projected for two years but under the terms of the settlement becomes a definite and immediate objective. Gulbenkian and the French contended they would not be able to get more oil from IPC operations unless this line were completed. At the present time IPC production is limited by pipe line capacity to transport the crude from the land-locked Kirkuk field. Since 1935 a dual pipe line has been in operation from the field to Haifa and to Tripoli, Lebanon. This existing 12-inch line is being supplemented by a parallel 16-inch system now under construction. The south leg of the new line, running to Haifa, Palestine, is virtually laid, and work is to be pushed promptly on the north leg to Tripoli. Normal throughput of the present 12-inch system is 90,000 barrels a day. Completion of the 16-inch parallel system will bring the total to about 300,000 barrels a day, while the 30-inch line will add another 300,000 barrels a day—giving a 1952 possibility of more than 600,000 barrels daily.

Liberalized Agreement

6. The new working arrangement among the IPC partners is definitely not a re-writing of the 1928 company contract. Rather it is described as a "liberalizing" treatment of the previous contract.

The revised arrangement is expected to step up sharply Middle East production in both Iraq and Saudi Arabia. Jersey Standard acquires a 30 percent interest in Aramco and Socony takes a 10 percent ownership of that company, while Standard Oil Company of California and The Texas Company reduce their interests to 30 percent each. Pending settlement of the dispute, agreement was reached in March, 1947, whereby Jersey Standard is to guarantee $76½ million of bank borrowings by Aramco, while Socony guarantees $25½ million. In both cases the purchase payments will be used to retire the loans.


GEOLOGIC STRUCTURE
SSC
ACCURATELY REVEALED
WORLD WIDE EXPERIENCE
CONSULTING EXPLORATION GEOPHYSICISTS
★ Seismograph Service Corporation of Delaware (South America)
★ Westby Geophysical Corporation (Mexico and Bahamas)
★ Seismograph Service Limited (Sterling Area)
★ Seismograph Service Corporation of Venezuela
★ American Exploration Company (U. S. A.) Marine
Seismograph Service Corporation
TULSA, OKLAHOMA, U. S. A.

Middle East Production Makes Sharp New Gains

SAUDI Arabia and Kuwait again registered substantial gains in production as development proceeds. During September the two newest producing nations in the Middle East together accounted for more than 600,000 barrels of crude daily, with Kuwait averaging 160,266 barrels a day, and Saudi Arabia 441,101.

These gains probably will continue with transportation facilities likely to be called upon to move more than ¾ million barrels daily from the two areas by the end of the year. Saudi Arabia had a number of days in late October and November when its production went above ½ million, and reports indicate that only a little more than one-half of the wells are kept on steady production. Kuwait's September production was up about 9000 barrels daily from August, and preliminary reports show it currently climbing well above that.

Iran's output continued its climb with a September daily average of 559,326 barrels, compared to 551,673 barrels daily in August to offset a decline of about 7400 barrels daily in Iraq, which is still restricted to the amount which can be moved through only one leg of the pipe line to the Mediterranean. With Egypt registering a gain of nearly 4000 barrels a day during September, the total Middle East output for the month stands at 1,231,244 barrels or 31,404 barrels a day more than were produced in August from the same area. Shortly after the first of the year increases are expected to be registered in Iran, where new pipe line outlets from Gach Saran will make another 100,000 to 150,000 barrels daily available at the Bandar Mashur terminal.

Canada continued its steady gains with the Prairie Provinces reducing Canada's deficit of indigenous production as development proceeds at Leduc and Lloydminster.

Partial figures for Venezuela indicate production still moving up although with only a slight possibility that it will reach a figure of 1,400,000 barrels a day by the end of the year. At the end of September it was slightly above 1,360,000 barrels daily with gradual gains being effected by Creole Petroleum Corporation, Shell and Mene Grande the principal producers. Production is to be bolstered in the near future by the output from newer areas not yet fully connected.

Crude Oil Production

COUNTRY	COMPANY	PRODUCTION—In Barrels		
		Month	Barrels	Daily Average
‡Brazil	Conselho Nacional do Petróleo	August	11,825	381
Canada (Western)	All Operators	August	1,229,876	39,641
Ecuador	Anglo-Ecuadorian Oilfields	September	133,546	4,452
	Ecuador Oilfields, Ltd.	September	51,099	1,703
‡Egypt	Anglo-Egyptian Oilfields	September*	952,988	34,035
‡France	All Operators	July	24,109	777
		August	33,109	1,068
‡Germany	All Operators	September	390,971	13,032
‡Iran	Anglo-Iranian Oil Company	September	16,779,772	559,326
‡Iraq	Iraq Petroleum Company	August	1,132,000	36,516
‡Kuwait	Kuwait Oil Company	September	4,807,986	160,266
Peru	Lobitos Oilfields, Ltd.	September	189,323	6,311
‡Saudi Arabia	Arabian American Oil Company	September	13,233,028	441,101
Trinidad	Apex (Trinidad) Oilfields	September	248,366	8,279
	Kern Trinidad Oilfields	September	36,431	1,214
	Trinidad Central Oilfields	September	42,080	1,403
	Trinidad Leaseholds, Ltd.	September	506,975	16,899
	Trinidad Pet. Dev.	September	214,150	7,138
	United British Oilfields	September*	414,965	14,820
Venezuela	British Controlled Oilfields	September	29,341	978
	Ultramar	September†	318,150	11,363
	Venezuelan Oil Concessions	September*	9,363,413	334,410

*4 weeks ending September 27. †4 weeks ending October 2. ‡Complete figures.

Danish American Exploration In Denmark May Be Halted

After spending about $5 million on exploratory work in Denmark, Danish American Prospecting Company may be allowed to pursue its investigations for no longer than six months more. Gulf Oil Corporation, which purchased the Danish American company in 1938, has been notified by the Danish government that it is limited to another six months in its mineral exploration and exploitation rights in Denmark.

The status of the company is not exactly clear, since at first Copenhagen declared that the American rights granted in 1936 were no longer valid and would be taken up. Minister of Public Works Carl Petersen contended that the government was "tricked" into granting the concession to F. F. Ravlin, an American engineer, who first obtained the concession. Petersen claimed that in obtaining the concession two years before its acquisition by Gulf, the engineer had "planted" a lump of salt he claimed to have dug from the Jutland area. Ravlin, now in the U. S., calls the charge "ridiculous and unfounded in truth or fact."

Later clarification of the recent Copenhagen statement pointed out that Gulf's right would have expired by November 1 anyway and the government could have exercised its option of refusing an extension. Company officials declined to predict what kind of solution might be forthcoming. Petersen says the Danish government is ready to continue some kind of cooperation with the Americans after a new agreement is negotiated.

Burmah Firm Concentrates On Sind Area in Pakistan

Burmah Oil Company is concentrating on exploratory work in Pakistan, particularly in an area in the district of Sind. The work is localized in a belt about 30 miles long by 10 miles wide at Larkha, about 80 miles from Karachi. Aerial surveys and geological and geophysical work have in indicated favorable prospects and resulted in location of a wildcat which has reached 2000 feet. It is scheduled to 8000 feet.

Larkha, on the fringe of the Sind desert, is reached by roads from Khanot, a railway siding about 40 miles from Hyderabad. The company has done considerable work on roads and has installed a power station.

Dwellings have been built to accommodate more than 200 workers and a market and restaurant are nearly completed. Water for domestic purposes is being pumped from the River Indus, 15 miles away. A landing strip has been constructed for company planes.

Now the Marsh line will include

Witt OXYGEN and WELDING Gauges

On September 30, the Witt Gauge Division of National Pressure Cooker Company was acquired by Jas. P. Marsh Corporation. As a result, the broad line of Marsh instruments will be still further broadened to include oxygen and welding gauges.

The Witt oxygen and welding gauges will be manufactured in the main Marsh plant by the "Witt Gauge Division of Jas. P. Marsh Corporation."

To users of oxygen gauges this is a significant development. It means that the respected quality of the Witt line will be further heightened by Marsh experience and the unmatched facilities of the new Marsh plant.

WITT GAUGE DIVISION OF

JAS. P. MARSH CORPORATION

U. S. Interests May Help Develop Iranian Oil

Iranian officials disclosed that five members of Overseas Consultants, Inc., an American group, are leaving the U. S. to take part in a vast survey of Iran's economic possibilities.

This brings speculation as to whether American oil interests may participate shortly in petroleum industry operations in Iran. While nothing definite along this line has been announced, it is known that the American engineers are contracted to take an active part in a seven-year, $650 million program for the expansion of Iranian economy, including petroleum production.

While the study will be broadly economic and social it is expected to concentrate in Iran's oil resources and the project will be paid for by funds from oil royalties. Overseas Consultants, Inc., is headed by Clifford S. Strike and was formed last year to conduct a survey in Japan's industries. The entire work in Iran is to be financed by the local government and the aid of 11 American concerns is to be enlisted.

Iran is still the leading oil producer in the Middle East, with production for this year likely to reach more than 170 million barrels. Its oil has been controlled by the Anglo-Iranian Oil Company, a British concern owned partly by the British government. There have been indications of late that American companies may at last obtain a part of the huge production, while not actually sharing in operations. The Agha Jari field is expected to supply an extra 100,000 barrels a day at the Persian Gulf port of Mashur, beginning next Spring. All of this increased output may go to the U. S., and Socony-Vacuum Oil Company alone has contracted for 40,000 barrels a day.

In addition, the projected pipe line from Iran to be operated by Middle East Pipe Lines, Ltd., with a terminal on the Mediterranean, is to be one-half owned by American companies.

While the British until recently have successfully maintained their exclusive hold on Iranian oil, American companies have made a number of efforts to gain a foothold there. A few years ago Soviet Russia manifested an interest in Iran and signed a provisional agreement for concessions in the country's five northern provinces. This arrangement was later cancelled by the Iranian Parliament and Russia has been exerting new pressure for oil rights.

Some industry observers feel that Iran itself has become doubtful of the advantages of exclusive British interests, especially from a military defense point of view, and has notified London that the entry of Americans into Iran is the only feasible way to keep the Russians out. The State Department and other government agencies have opposed Russia's efforts to win a foothold in Iran, and it is believed that official U. S. blessing would be given any sound program by which American companies could participate in the future development of Iran's oil.

Refinery in Sweden Slated For Completion by Spring

Sweden is expected to have a new refinery by next spring. The plant is being built at Skarvik, near Gothenburg, by the Olje Ab Koppartrans and is expected to have a capacity of 11,000 barrels throughput daily at the time it commences operation. Plans call for doubling this within a short time.

The refinery is one originally ordered by the Chinese government during the war but had never been shipped from the U. S. It was sent to Sweden in packaged form. In addition to products which should result in a substantial saving in exchange balance for Sweden, the plant is expected to produce enough gas to supply the whole Gothenburg area. It is also slated to turn out plastic products, synthetic rubber, nylon and fertilizers.

Second Hydrogenation Plant Scheduled for Germany

An agreement sanctioned by the Oil Branch Fuel & Power Division will make another German hydrogenation plant available for processing crude oil to help satisfy civilian and industrial requirements. Thus, the plant at Gelsenberg will now add its capacity to that of the Wesseling plant for the processing of oil residues.

The agreement calls for operation by Socony-Vacuum Oil Company's German affiliate of the Gelsenberg Benzin A. G., plant. Dutch Shell had already concluded an agreement on the plant at Wesseling. Each of the plants will probably treat so much crude in their top distillation units that a residue of about 100,000 barrels will be available for hydrogenation. With a 40 to 50 percent residue from topping this means that the two plants will process about ½ million barrels a month. Through use of the high-pressure hydrogenation process it is believed that the residue will yield about 77 percent gasoline, which will be in addition to the gasoline gained by topping.

The principal raw material for the two plants will be crude imported from Kuwait and Saudi Arabia through the Marshall Plan. When the processing program is fully in operation both plants will have a throughput of from 5 to 7 million barrels a year, corresponding to nearly one-half of the present yearly consumption of oil products in the Western occupation zones.

Syrian Petroleum Abandons Wildcat in Aleppo Area

Syria Petroleum Company, subsidiary of Iraq Petroleum Company, has abandoned the first of its series of wildcat wells started at the end of the war. Bafloun 1, about 30 miles northwest of Aleppo, was abandoned after reaching 8666 feet without finding oil or gas. The well was drilled as a test of the Middle Cretaceous and Jurassic limestones. At total depth it had penetrated the full Mesozoic series without finding shows and was in steeply dipping Paleozoic beds at the time it was abandoned.

Germany's Production Gains Lower Forecast of Imports

Forecasts in Germany indicate that crude imports during the first half of 1949 will probably amount to 2½ million barrels. This is somewhat less than had been anticipated under the original framework of the Marshall Plan, but has been lowered in view of the increases in indigenous production, particularly from the Emsland fields and in the Hanover area. Imports of crude in the current half year of 1948 approximated 1,365,000 barrels. Oil is coming from both Venezuela and the Middle East. In the first half of 1949 it is presumed that slightly less than two-thirds of the imports will be Middle East crude with the remainder from Venezuela.

A recent meeting in Hamburg of the Mineral Oil Association for Free Competition went on record with unanimous agreement on the principle of unrestricted free competition in importing crude oil. The association is composed of oil refinery operators, dealer organizations and importers. In the opinion of the members the present system of state monopolized purchase of the necessary crude imports from abroad should be replaced as soon as possible.

Merry Christmas

WHEREVER YOU ARE . . .

Whether it be in the warmth of your home or in a far-off land, may the true Christmas spirit bring you joy . . . and happiness throughout the years.

GEOPHYSICAL SERVICE INC.

DALLAS, TEXAS

Sechura Contract Delayed By Peruvian Disorders

Recent political disturbances in Peru have blocked hope for immediate approval of the controversial Sechura concession contract by which Standard Oil Company (N. J.) would win rights for the exploration and development of another 5 million acres of Peruvian coastal desert. Company officials admit that the whole status of the contract is uncertain pending the outcome of political developments in Peru.

The Sechura concession contract was negotiated by Jersey Standard's subsidiary, International Petroleum Company, nearly three years ago, but ratification has not yet been extended by the Peruvian Congress. Meantime, the contract has been under constant attack by left-wing labor and political elements in Peru as a "sellout to Yankee imperialism" The proposal was indorsed by the former president, Jose Luis Bustamante and the Apra party, but was widely critized by the conservative Alianza Nacional party. While opposition to the contract has ostensibly centered around the claim that its terms are unfair to Peru, it is known that many Peruvian business men and industrialists oppose it because they fear a general uplift of Peruvian wages if American capital starts operating in the country.

In April, 1948, the dispute over the contract resulted in the creation by Bustamente of a government petroleum agency, Empresa Petrolera Fiscal, which is authorized to deal with private oil companies without congressional sanction. International and other U. S. concerns are far from ready to undertake operations in Peru under decree authority which does not provide adequate protection of investment and program.

The final setback to the contract occurred with the recent Callao revolt, the illegalizing of the Apra party, and the ousting of Bustamante by Gen. Manuel Odria.

The contract would give Peru an advance payment of $3½ million by International plus later investments to the amount of $1½ million for public works. The region covered by the contract would be ten times as large as the adjoining land now under operation by International. International and other companies also have considered inland exploration east of the Andes, linking the vast Montana area with the coast by a trans-Andean pipe line to cost between $200 million and $400 million.

Petroleum is vital to a sound development of Peru's economy, especially in view of sharply rising internal demands for oil, a situation which on the basis of present trends will make Peru a net oil importer with'n a few years.

Colombia to Encourage Oil Exploration and Production

Oil exploration and production will be encouraged in Colombia through a new, healthy political climate, according to David Donoghue of Fort Worth, just returned from consultation with officials of the Colombian Government.

He pointed out that decreasing interest on the part of foreign oil operators has led President Mariano Ospina-Perez to authorize a panel of technicians from the U. S. to consult with Minister Alonzo Aragon Quintero of Mines and Petroleum, and Felix Mendoza, president of the National Petroleum Council, who are leaders in a movement to remove many legislative restrictions discouraging to oil operators. One of the particular points causing concern is that portion of the current regulations concerning ownership of mineral rights. Since private ownership of mineral rights prior to 1873 supersedes that of the government, extensive litigation is involved in establishing proper claim so that applications for concessions may be processed and contracted. More often than not, this process requires years before title is cleared sufficiently for the concession to be awarded.

Responsible Colombian officials agree that this is a burden on exploration that should be dealt with in order that the country may gain a prominent position in the world oil picture.

In addition to Donoghue, who is a consulting geologist and engineer, the panel of consultants included Professors George H. Fancher of the University of Texas and W. L. Nelson of the University of Tulsa. The fourth consultant was Max Thornburg, advisor to the Sheikh of Bahrein. Thornburg acted as advisor on legal problems, while the other members of the panel were concerned chiefly with a technical evaluation of the De Mares concession, operated by Tropical Oil Company.

Caltex Planning Refinery In Cartagena, Spain Area

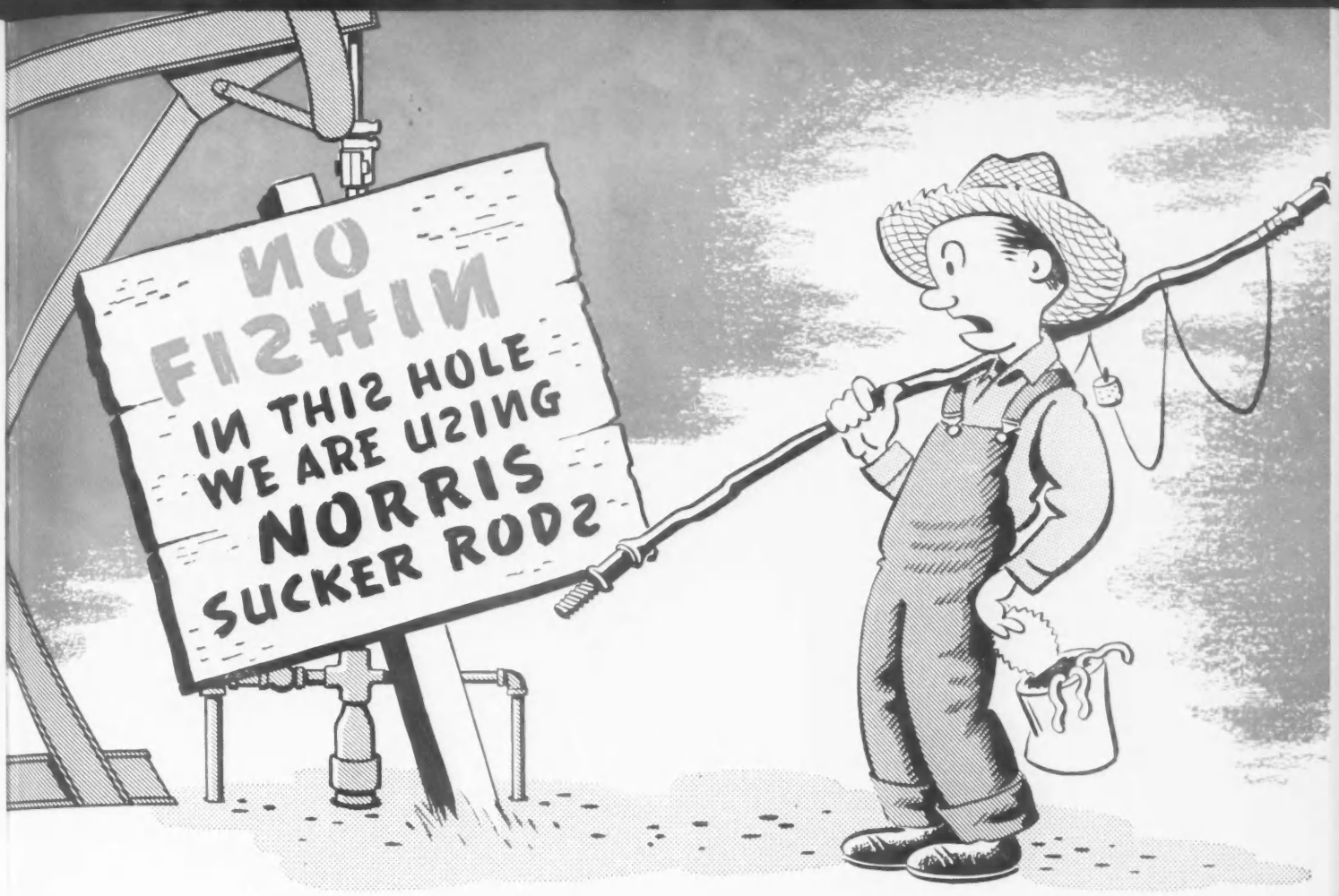
Caltex Oil Products Corporation, a joint subsidiary of The Texas Company and Standard Oil Company of California, plans to construct a 15,000 to 20,000 barrel a day refinery in Spain at a cost of approximately $20 million. Caltex officials confirmed that the deal has been signed and company engineers are en route to Spain to survey sites. The plant is expected to be built in the vicinity of Cartagena and reportedly would be owned 24 percent by Caltex, 24 percent by Compania Espanola de Petroleos, S. A. (Cepsa), and 52 percent by Instituto Nacional de Industria, a Spanish government banking corporation.

The program is significant as indicating the first change of policy in Spain's petroleum monopoly which was instituted in 1929 by Dictator Primo de Rivera for a 20-year period. Since that time, foreign capital and skills have been excluded from Spain and petroleum product prices have soared to highest levels in Europe. In 1928, before institution of the government monopoly, gasoline sold in Spain at 23 cents a gallon; in 1948 it was selling around $1.70 a gallon.

A Caltex official reported that Spain has erected some needed facilities, chiefly storage installations, but that no new plant units have been installed. Caltex estimates that several months will be required to determine just what installations are necessary for the new project.

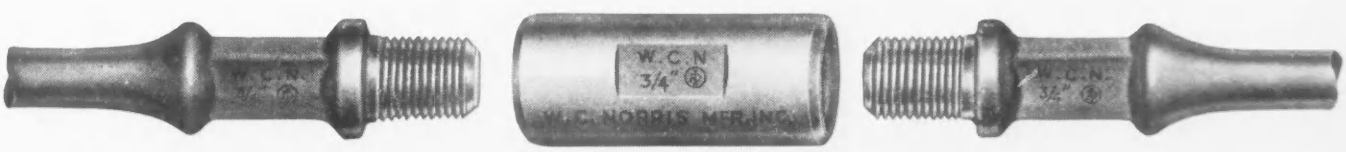
The Spanish oil monopoly, set up for a period of 20 years, expires January 1, and many industry officials are speculating whether Spain plans to relax her petroleum law and seek foreign capital again. Best guess seems to be that Spain will permit "mixed" company operations, partly owned and perhaps wholly controlled by the government. There has been widespread protest within Spain from many industrial groups as to the high prices prevailing for petroleum products. Also, Spanish taxpayers are unsympathetic to the oil monopoly because of its heavy drain on public funds. During the last ten years the monopoly is estimated to have piled up a cumulative debt of 170 million pesetas.

Following the end of World War II Spanish oil markets were supplied largely by U. S. companies with foreign selling facilities. Caltex has been supplying about a third of Spain's oil requirements with crude delivered from the Middle East.



Fishing for FISH is fun, but there's no enjoyment in fishing for equipment thousands of feet below the surface of the earth. Down time due to inferior rods is lost time and money. NORRIS FULL-LENGTH NORMALIZED SUCKER RODS are NEVER inferior. Each rod undergoes five rigid inspections during its manufacturing process. This process includes forging, normalizing, heat treating and precision threading to exact A. P. I. specifications. Quality materials and Quality workmanship give NORRIS SUCKER RODS that Top Performance you're looking for.

For complete information and specifications on NORRIS SUCKER RODS, POLISHED RODS, PULL RODS and COUPLINGS, write for Bulletin No. 28-B.



W.C. NORRIS, MANUFACTURER, INC.

TULSA, OKLAHOMA

BRANCHES:
HOUSTON, KILGORE, ODESSA, TEXAS; SALEM, ILLINOIS

EXPORT:
30 ROCKEFELLER PLAZA, NEW YORK CITY

Since QUALITY NORRIS PRODUCTS 1882

WEST COAST DISTRIBUTORS:
HICKEY PIPE & SUPPLY CO.
Los Angeles

American Independent May Get Neutral Zone Rights

With recent announcement by Arabian American Oil Company that it will relinquish preferential rights to the Neutral Zone between Saudi Arabia and Kuwait comes speculation as to the possibility that American Independent Oil Company may obtain full rights in the area.

It is reported that Arabian American dropped its claims on Saudi Arabia's interest in the neutral zone as a result of an exchange agreement whereby its claims for tidelands rights is confirmed. Aramco held that its original concession also included the offshore rights, although such production was not anticipated at the time the concession agreement was drawn. It is understood that King Ibn Saud contended the offshore rights in the Persian Gulf were not necessarily included in the Aramco concession. Completed negotiations now establish Arabian American's interest there as the company yields its former undisputed rights in the neutral zone. Aramco will pay a 10 percent royalty bonus on production from the Persian Gulf tidelands area over and above its base royalty figured on mainland production.

Such an arrangement is expected to clear the way for making an operating agreement on the Kuwait neutral zone. The Sheikh of Kuwait and King Ibn Saud exercise an "undivided" sovereignty over the neutral zone, and such an arrangement has raised questions as to how a concession could be operated there, particularly if two operators are involved. American Independent holds rights on the Kuwait undivided one-half interest. Since the division is not on a territorial basis it has remained an unsolved problem as to what course of action was open to American Independent in exploration and production in the neutral zone that would not infringe on the Saudi Arab rights.

American Independent, a group of independent American firms headed by Ralph K. Davies, is believed to be the leading bidder for Ibn Saud's neutral zone interest. If he should grant it to them it would leave American Independent as the holder of full concession rights in this region.

Charles Rayner, an official of American Independent, has spent some time recently in the Middle East, and it is reported he is looking to the acquisition of full American Independent Oil Company rights in the zone.

Methane Gas Pipe Line Planned From Adria to Northern Italy

A pipe line network to bring methane gas from Adria, near the mouth of the River Po, to the industrial areas of Northern Italy is now being planned, according to Dr. Kotlenko, president of the Italo-American Methane Company.

The principal pipe line will run from Adria through Rovigo, Ferrara, and Bologna to Caviaga, where the Italian company, AGIP, has already constructed a methane gas pipe line to Bergamo and then to Milan, where it will divide into three branches running to Varese, Como, and Genoa.

This is a development of the plan proposed last year by the American expert, J. D. Creveling, for a pipe line from Adria to Milan with branches to Venice, Treviso, Padua, Vicenza, Rovigo, Ferrara, Bologna, Mantua, Verona, Reggio, Emilia, Parma, Modena, Cremona, Piacenza, Brescia and Bergamo.

The new pipe lines, which are expected to be completed during 1951, will transport about 55 million cubic feet of methane gas a day. Materials are expected to come partly from the U. S. and partly from Italy.

A pipe line is at present under construction from Contarina to Marghera in the Venice District, which will carry 2 million cubic feet of gas daily to the industries in the Port Marghera area. Construction is being carried out by Azienda Metanodotti Padani, 50 percent of whose capital is in the hands of Jersey Standard and the balance in the hands of the Italian Government through the Ente Metano.

The Italian Ministry of Industry is to fix the consumption of gasoline for the current year at the same level as in 1940, when Italy's consumption amounted to about 2,800,000 barrels, but will allow the consumption of 671,300 barrels more gasoil and 1,876,700 barrels more fuel oil than the 2,128,700 barrels and 7,223,300 barrels respectively, consumed in 1940.

Gasoline, gasoil, and fuel oil are to be marketed up to the 1940 totals at the rate of 80 percent by the AGIP, Shell and Standard-Vacuum Groups and 20 percent by other concerns, but half the increase in gasoil and fuel oil quotas over 1940 will be supplied by the big petroleum companies, and half by the other concerns.

Italy hopes to produce about 3,794,000 barrels of gasoline this year using crude oil imported from the Middle East. However, the best gasoline that the Italian refineries are able to produce today is about 10 to 12 octane below that produced before the war, while lubricating oil, aviation gasoline, and kerosine have to be imported.

Gasoline now being produced in Italy comprises 75 percent primary spirit of 46 to 50 octane, 15 percent obtained by thermal cracking of 60 to 65 octane, and 10 percent obtained by the polyform process of 68 to 70 octane, giving an average octane rating for the finished product of only 50 to 54.

Refinery at Pladjoe, Sumatra, Restored to Prewar Capacity

The Bataafsche Petroleum Maatschappij has announced that its refinery at Pladjoe, near Palembang, Sumatra, including the aviation gasoline plant, has been fully restored and is now working at prewar capacity.

Geophysical Operations Reach New High in Western Canada

Geophysical operations in Western Canada have been stepped up to the highest level in history as the search for oil, backed mainly by American capital, expands. There are now 55 crews in operation, including 43 seismograph, 11 gravity, and one magnetometer. Of these, 50 crews are in Alberta, two in Saskatchewan and three in Manitoba. In 1947 the peak number of crews was 22, while in 1945 and 1946 it was 15.

In addition to the geophysical parties, Alberta has eight structure test drilling units at work and Manitoba has one.

1948 Western Canadian Geophysical Operations

COMPANY	Seis.	Grav.	Mag.
Anglo Canadian Oil Co.	..	..	..
Amerada Petroleum Corp.	3½	..	..
Barnsdall Oil & Honolulu Oil	2	..	..
British American Oil Co.	2	..	..
California-Standard Co.	5	3	..
Canadian Gulf Oil Co.	3	1	..
Consumers' Exploration Co.	1	..	..
Hudson's Bay Oil & Gas Co.	2½	1	..
Imperial Oil, Ltd.	9	3	1
Husky Oil & Refg., Ltd.	..	1	..
McColl-Frontenac (Texaco)	5	..	..
Pacific Pete Et. Al.	..	1	..
Rio Bravo Oil Co.	2	..	..
Royalite Oil (Imper.)	1	..	..
Shell Oil Co. of Canada	..	..	..
Stanolind Oil & Gas Co.	3	..	..
Socony-Vacuum Exploration	3	1	..
Sun Oil Co.	..	..	..
Tower Petroleums, Ltd.	1	..	..
Total	43	11	1
Maximum Parties Operated	.....	55	

NOTE: Included in crews above are crews in which Anglo Canadian Oil Participated with Imperial & Tower Pete in 1948; and in which Anglo Canadian, Home Oil and C. & E. Corporation Participated with McColl Frontenac-Texaco in 1948.

NEW AND IMPROVED Equipment SUPPLEMENTING COMPOSITE CATALOG

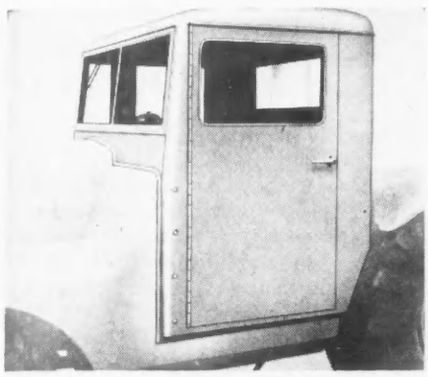
New and improved equipment of manufacturers who describe their products or services in the current Composite Catalog

210—Cab

This item supplements the Caterpillar Tractor Company's data as shown on pages 994-995 of Composite Catalog.

An all-steel welded cab has been designed exclusively for attachment on the new 115-horsepower "Caterpillar" diesel DW10 wheel-type tractor.

Offering year-around utility of the



tractor and eliminating the threat of job interruptions due to inclement weather, the cab provides increased comfort for operators and complete protection from the elements.

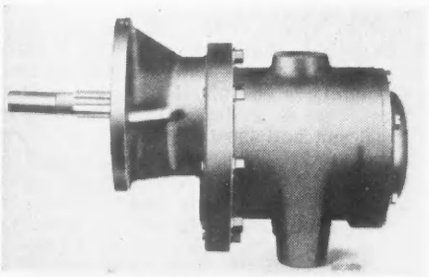
Of durable construction similar to that of the cab offered with the "Caterpillar" Diesel Motor Grader, the cab permits maximum visibility and maneuverability.

For additional information, write Caterpillar Tractor Company, Peoria, Ill., *referring to* WORLD OIL *item* 210.

211—Air Starter

This item supplements Ingersoll-Rand Company's data as shown on pages 1965-1969 of Composite Catalog.

Air motors of two sizes as starters for internal combustion engines are keyed or splined to the Bendix or starting mechanism, and the engine is cranked in the same manner as an automobile engine is turned over when using the electric starter. The starting motors are known as the size 9BM and size 20BM; the former having nine horsepower and the latter 20 horsepower at 90 pounds per square inch air pressure. They are small and compact having an overall length of only 13 3/16 inches and 14½ inches. The air motor is of the multi-vane type and the throttle valve is of the quick opening type to give peak horsepower almost immediately.

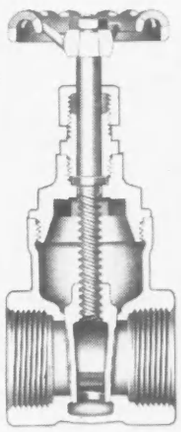


For additional information, write Ingersoll-Rand Company, 11 Broadway, New York 4, *referring to* WORLD OIL *item* 211.

212—Gate Valves

This item supplements Crane Company's data as shown on pages 1086-1087 of Composite Catalog.

The Crane Company's 100-pound brass gate valves are furnished in two types, the No. 410 screwed-end valve in sizes one-fourth-inch to two-inches, and the No. 1320 solder-joint valve in sizes three-eighths-inch to two inches.



The upper portion of the body of the valve is cylindrical, similar to the design that has been used only in steel valves for the highest pressures. This design combines maximum strength with light weight. The shape of the body, in addition to being ideal for resisting pressure, reinforces the seats against the wedging action of the disc and safeguards against distortion of the body when the valve is being seated.

The ends of the solder-joint design are made to fit closely over hard copper tubing. The close fit enables the solder to flow into the joint by capillary action. The joint is soldered by what is known as "end feeding," the solder being fed into the joint from the outer end of the socket.

The disc is the one-piece wedge type and is guided by means of long guides which assure correct seating. Valve seats are cast as part of the body. The stuffing box is packed with molded asbestos, and can be repacked while under pressure when the valve is wide open.

For additional information, write Crane Company, 836 S. Michigan Avenue, Chicago 5, *referring to* WORLD OIL *item* 212.

213—Heavy-Duty Connector

This item supplements The National Supply Company's data as shown on pages 2793-2892 of Composite Catalog.

Ideal Type E-54 connector features a fully articulated equalizing connection to the traveling block with straight-link suspension. Designed for 540 tons, it matches the capacity of the Type 660 companion traveling block.

The yoke member is carried on a long,

low-stressed spring and turns freely on a heavy-duty tapered roller bearing when not locked against rotation in any of eight positions, thus adapting the connector to all derrick practices.

For handling casing, a heavy forged steel clevis is furnished for connecting to the automatic casing elevator bail.

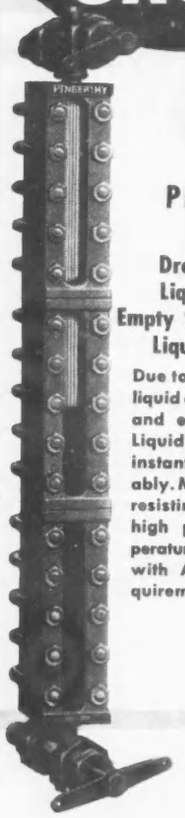
Length over-all of connector, less clevis, is approximately nine feet and net weight is three tons.

For additional information write The National Supply Company, Box 899, Toledo 1, Ohio, *referring to* WORLD OIL *item* 213.

PENBERTHY

REFLEX and TRANSPARENT

DROP FORGED STEEL LIQUID LEVEL GAGES



PENBERTHY
REFLEX
Drop Forged Steel
Liquid Level Gage
Empty Space Shows White
Liquid Shows Black

Due to "Reflex" principle, liquid always shows black and empty space white. Liquid level is indicated instantly and unmistakably. Made of temperature resisting alloy steel for high pressure and temperature service. Conforms with API and ASME requirements.

PENBERTHY
TRANSPARENT
Drop Forged Steel
Liquid Level
GAGES

Glass front and rear permits observation of color and density of liquids under high pressures and/or temperatures. Highest quality—made of temperature resisting alloy steel. Conforms with API and ASME requirements.

3277-C

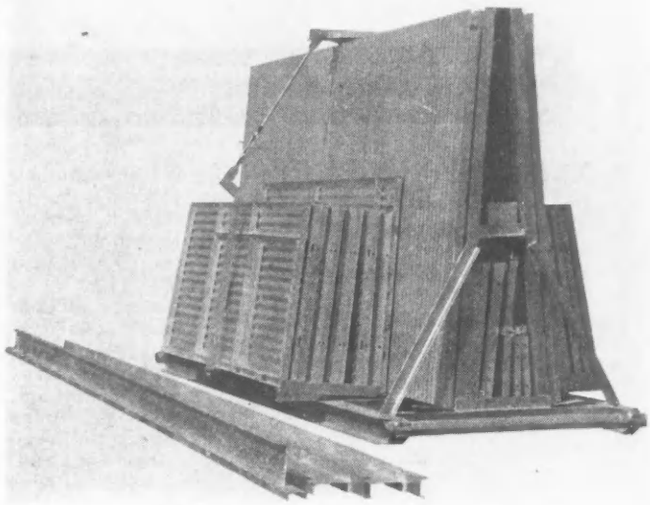
PENBERTHY INJECTOR CO.
Detroit 2, Mich.
Canadian Plant—Windsor, Ontario

NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

214—Steel Engine House

This item supplements Mid-Continent Supply Company's data as shown on pages 2669-2692 of Composite Catalog.



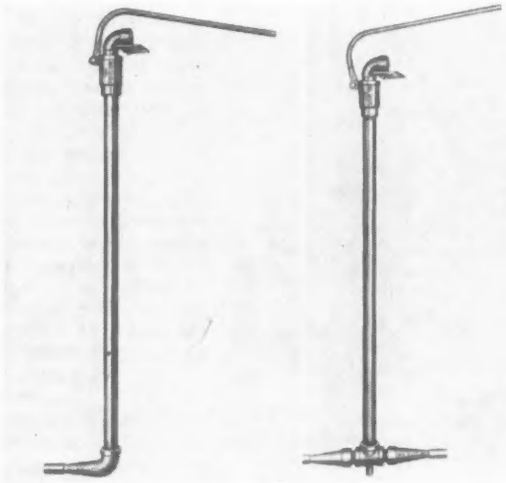
A steel engine house which is readily portable by truck is designed to give the benefit of indoor weather protection at a cost which does not exceed that of the usual make-shift engine house, when the cost is pro-rated over its long service life. It is easily adaptable to any sub-structure and rig, and it gives the rig a neat appearance, in addition to reducing the fire hazard.

Each section of the engine house is an angle-iron frame of welded construction, covered with galvanized corrugated sheet iron well united to the framing to form rigid panels. Structural steel members have bolt holes that line up to aid rapid erection. All wall and roof sections are interchangeable.

The complete engine house (except for three rafters) is delivered racked and clamped on a skid-type crate. Sections stand on edge so each section supports only its own height, keeping panels true and flat.

Large windows on two sides of the house open outward to provide ventilation and shade.

For additional information, write Mid-Continent Supply Company, Mid-Continent Building, Fort Worth, *referring* to WORLD OIL *item* 214.



215—New Mud Guns

This item supplements Oil Base, Inc. data as shown on page 3021 of Composite Catalog.

Three new mud guns, known as OB Mud Guns, are steel throughout. A unique thrust assembly in the swivel holds the gun on position when in use thereby eliminating the need for special locking devices and preventing "spinning." OB Mud Guns are perfectly balanced, safe to use and easy to operate. There are no packing glands to be adjusted and replaced. Nozzles contain a replaceable insert of Eld metal. All fittings have 2 inch standard pipe threads, and all parts are replacable on the job without requiring special tools.

The guns are available in top and bottom types. The "suction pit" mud gun is a bottom-type gun with a single nozzle capable of swinging 300° to cover all points of the pit. The "storage tank" mud gun is a double nozzle, bottom-type gun and used in the center of circular tanks. The "super-mix" is a top type gun employed where large sumps and open pits are in use.

For additional information write Oil Base, Inc. 130 Oris Street, Compton, Calif., *referring to* WORLD OIL *item* 215.

GULF

A complete line of quality petroleum products

GULF OIL CORPORATION
GULF REFINING COMPANY

General Offices, Pittsburgh 30, Pa.

Refineries:

NEW YORK, N. Y.
PHILADELPHIA, PA.
PITTSBURGH, PA.
TOLEDO, O. · CINCINNATI, O.
PORT ARTHUR, TEX.
FORT WORTH, TEX.
SWEETWATER, TEX.

Sales Offices:

BOSTON · NEW YORK
PHILADELPHIA · PITTSBURGH
TOLEDO
LOUISVILLE · ATLANTA
NEW ORLEANS
HOUSTON

QUICK, ACCURATE RESULTS
LESS EFFORT
Curtin CENTRIFUGES

No. 3420
15 c.c. machine . . .
Cranks and heads interchangeable with 100 c.c. machines.

Simple in design . . . Ruggedly built . . . Requires no special care . . . Great Ratio and throw of crank produce required speed with no strain. Curtin Centrifuges meet all *A.S.T.M. Standard Method D-96* and *A.P.I. Code No. 25* requirements. Fully descriptive literature upon request.

W·H·CURTIN & CO.
HOUSTON . . . . NEW ORLEANS.

DIAMOND CORING

brings. . .
✓ SPEEDIER PENETRATION
and. . .
✓ GREATER RECOVERIES

✓ DIAMOND CORE BITS
. . .for sale
✓ SPECIAL CORE BARRELS
for rent or sale
✓ SERVICE ENGINEERS

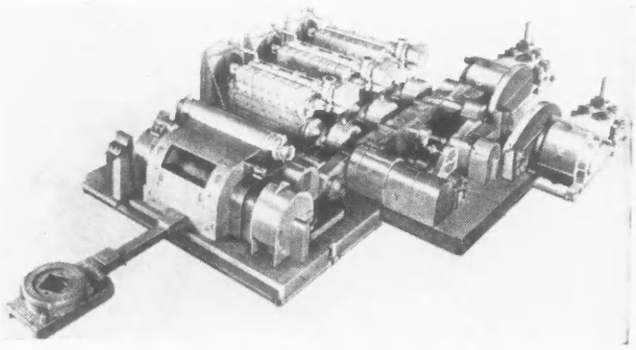
DIAMOND OIL WELL DRILLING COMPANY
815 MIDLAND TOWER PH. 2710
MIDLAND, TEXAS

NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

216–Drilling Rig

This item supplements The National Supply Company's data as shown on pages 2793-2892 of Composite Catalog.



Believed the largest diesel-powered drilling rig in the world for drilling oil wells is the Ideal Type 160. It is rated for 16,000-foot drilling with five-inch outside diameter drill pipe.

An operating feature of the 160 rig is the air-operated valves which control the principle operations of the rig. A feature of the drawworks is a spooling drum 36 inches in diameter and 61¼ inches long, and grooved for 1½-inch wire line. Water-cooled brake rims for the drum are 62 inches in diameter and 10-3/8 inches wide. Air-operated compound equilizing brakes are used, and 42-inch and 36-inch Ideal air-operated friction clutches are provided for the low and high drum drives respectively. Ideal air-operated friction-type catheads have been incorporated as built-in equipment. Six hoisting speeds are provided through the three-speed, air-clutched transmission on the No. 1 engine sectional frame in combination with the high and low drum drive clutches.

The rotary machine, Ideal Type SHS-20½, is driven through a shaft drive from the drawworks also at six speeds. The Ideal micromatic drilling control permits precision feeding of the drill bit.

For additional information, write The National Supply Company, Box 899, Toledo 1, Ohio, *referring to* WORLD OIL *item* 216.

217–Weight Indicator

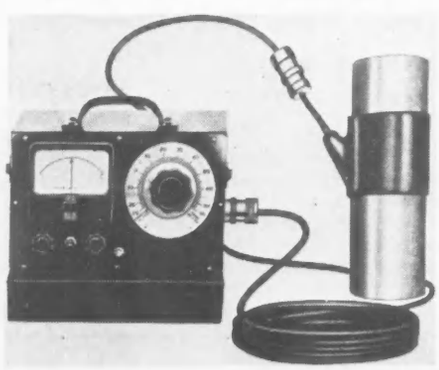
This item supplements Byron Jackson Company's data as shown on pages 797-896 of Composite Catalog.

An electronic weight indicator, model 500A, is designed for measurement of any operation in which the tension load does not exceed 75 tons or the compression load exceed 150 tons. It is recommended for controlled setting of cement retainer, bridging plugs, and fiishing operations.

The weight indicator operates on the null balance principle and translates electrical impulses from the connecting sub into precise weight readings. It provides coarse and fine adjustments of instrument balance. Subs are equipped with electronic strain gages and compensated for internal pressure effect.

All leads on the sub are fully protected by a heavy, vulcanized sleeve of tough rubber. The working parts of the indicating instrument are within 2 percent of the full-scale load. Temperature changes have no effect on the accuracy of the readings. There are no changes in readings due to variations of fluid pressure within the sub.

For additional information, write Byron Jackson Company, 2300-2301 E. Vernon, Los Angeles 54, *referring to* WORLD OIL *item* 217.



WEST TEXAS Engineering SERVICE

FOR
OIL FIELD PROPERTY MANAGEMENT

- GAS-OIL RATIO SURVEYS
- SUB-SURFACE PRESSURE AND TEMPERATURE SURVEYS
- WELL TESTS
- ENGINEERING ANALYSES AND APPRAISALS
- SUPERVISION OF PRODUCTION, DRILLING & ROYALTY INTERESTS

PRICES FURNISHED ON REQUEST

P. O. Box 1299 Phone 225
Rhodes-Chapple Bldg. MIDLAND, TEXAS

Take advantage of HYATT Experience

As builders of the first, and today the finest roller bearings, Hyatt, in more than half a century, has accumulated a lot of application experience which should be helpful to you.

Hyatt engineers are at your service, glad to assist you in solving your bearing problems whether you are designing a new machine or piece of equipment or modernizing an existing design.

Hyatt Roller Bearings are used by thousands of leaders in the automotive–industrial–agricultural–petroleum–construction and transportation fields. Costs you nothing to invite a Hyatt man to confer with you. Hyatt Bearings Division, General Motors Corporation, Harrison, N. J.

HYATT ROLLER BEARINGS

NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

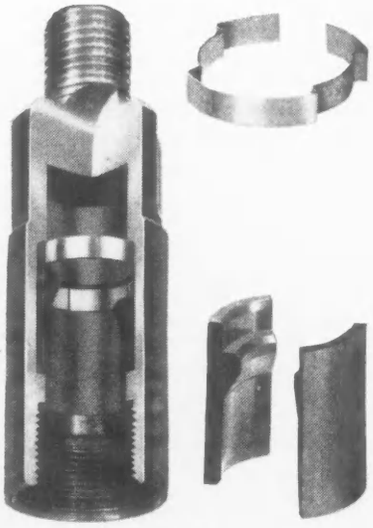
218–Pump Cage

This item supplements John N. Martin, Manufacturer's, data as shown on pages 2537-2539 of Composite Catalog.

A cage for oil well pumps employs long lasting, replaceable, resilient synthetic rubber ball guides. These guides are not appreciably affected by oil, have high abrasion resistance, and are not subject to the beating or peening action of the spinning ball. In addition to the improved cage life obtained, there is generally a marked improvement in the Ball & Seat life, because of the protection afforded the ball.

They are available in open and closed types, in sizes 1½-inch and larger.

For additional information, write John N. Martin, Manufacturer, 11 West Brady, Tulsa, *referring to* WORLD OIL *item* 218.



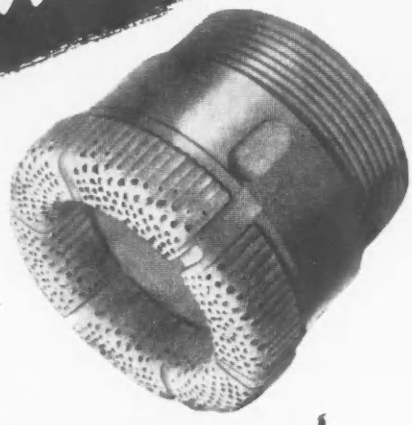
219–Pump Jack

This item supplements Axelson Manufacturing Company's data as shown on pages 301-336 of Composite Catalog.

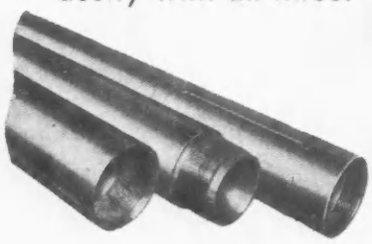
The Axelson hydraulic pump jack is adaptable to polished rod loads up to 32,000 pounds and strokes of 25 feet or longer. It features a constant load on the rods with soft, cushioned reversals and ability to pump from unusual depths without rod failures. The jack operates on a low-pressure cycle, is easily portable, and simple to understand and service. Another feature is the extreme ease with which this unit permits spacing the well.

For additional information, write Axelson Manufacturing Company, Box 98, Vernon Station, Los Angeles 11, *referring to* WORLD OIL *item* 219.

Check ✓ and Triple Check ✓✓✓



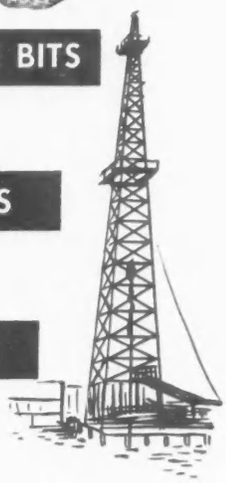
Christensen Diamond Products Company supplies the petroleum industry with all three:



DIAMOND CORE BITS

CORE BARRELS

FIELD SERVICE



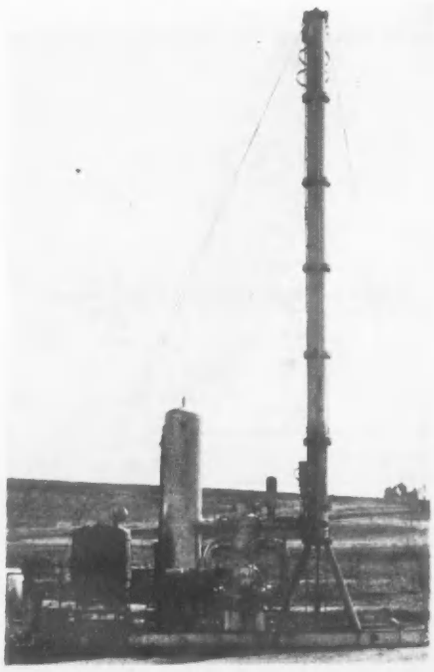
One uniform product standard . . . plus competent assistance in the field by trained servicemen assure you always

LESS COST PER FOOT when you choose Christensen to do the job.

LESS COST PER FOOT CHRISTENSEN DIAMOND PRODUCTS

CHRISTENSEN DIAMOND PRODUCTS CO.

1975 South 2nd West • Phone 6-8738 • Salt Lake City, Utah



FIRST...

FOR SECONDARY RECOVERY!

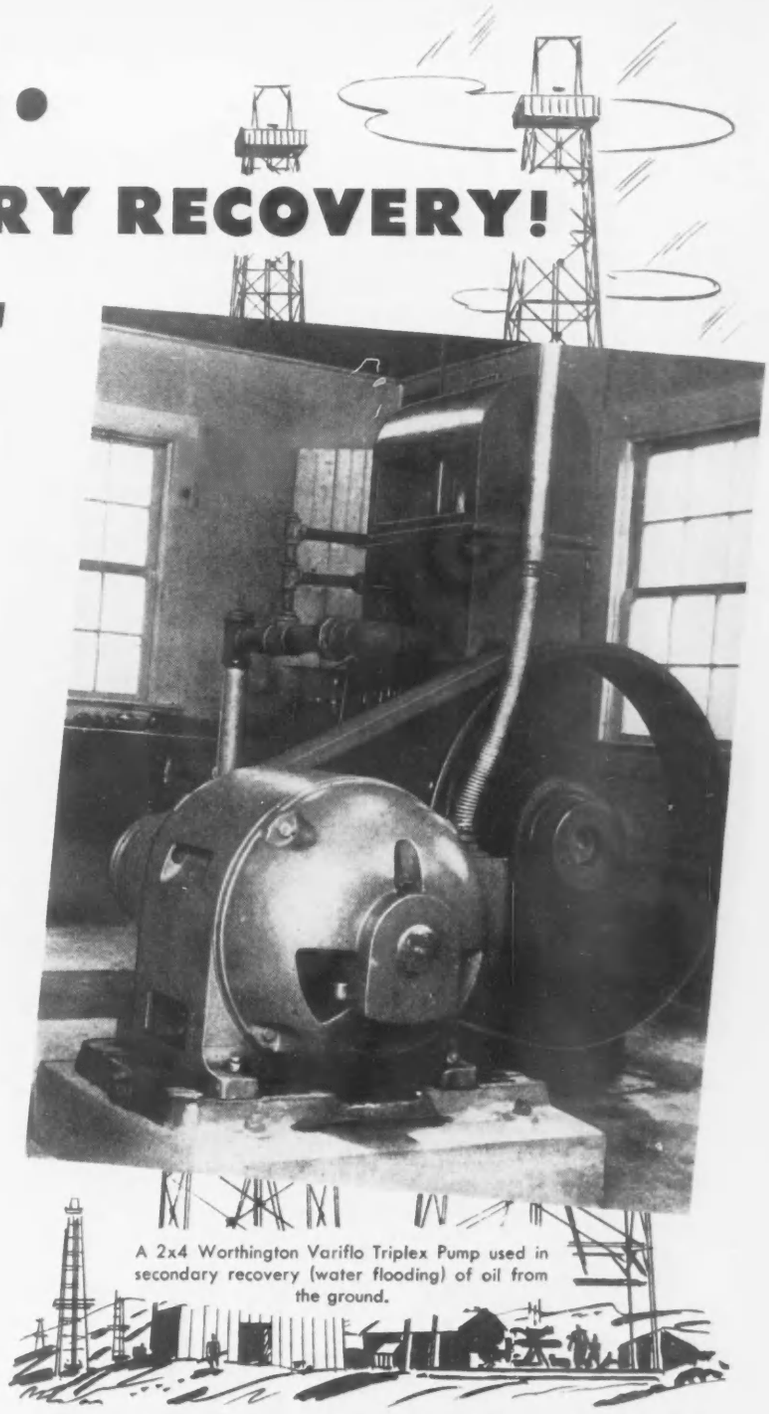
There's nothing like a Worthington Variflo for water flooding

Back in the days of oil field pioneering Worthington found that *constant* water pressure was needed to displace recoverable oil — and that any reduction of pressure meant loss of production. Because the ordinary pumps used for this service were also doing other water-pumping jobs, pressure was constantly fluctuating — and recoverable oil was being lost.

Worthington Found The Answer in Variflo Triplex Pumps. Providing constant pressure at all times, Variflos automatically vary their capacities to compensate for water withdrawn *for any other purpose.*

Operating on any standard air-type pressure controller, Worthington Variflo Pumps bring stepless, automatic variation — *from zero to 100%*. Except for the variable capacity feature, Worthington VTE Pumps offer the same advantages in constant capacity design.

Exclusive Features make Variflos and VTE's the most efficient money-savers in many other oil field applications. For further facts proving *there's more worth in Worthington*, write to *Worthington Pump and Machinery Corporation, Reciprocating Pump Division, Harrison, New Jersey.*

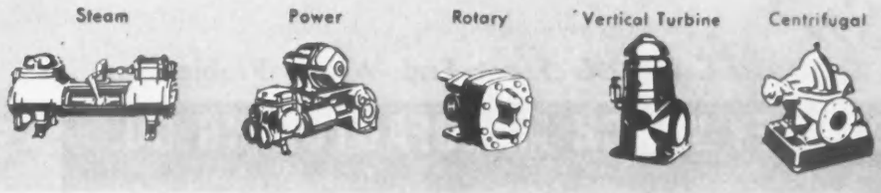


A 2x4 Worthington Variflo Triplex Pump used in secondary recovery (water flooding) of oil from the ground.

WORTHINGTON

PS-7

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB



NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

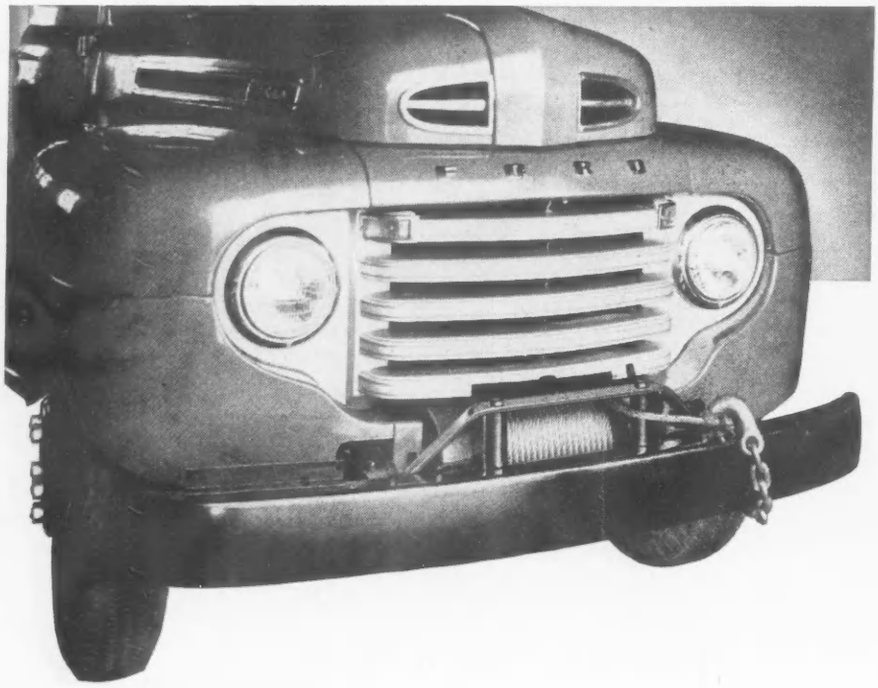
220–Hydropress Pumps

This item supplements Byron Jackson Company's data as shown on pages 797-896 of Composite Catalog.

The Hydropress pump is an adaptation of the simple and efficient centrifugal pump to high-pressure, low-volume pumping, standing in direct contrast to the complex displacement type pump.

Characterized by inherent hydraulic balance, the Hydropress is said to have perfect balance of axial and radial forces over the entire load range. There are no extraneous devices such as a balance disc, drum, or floating seal. Balanced radial forces are achieved through the unique double volute design of the inner case. Axial thrust balance is provided by opposed grouping of the impellers. Double case design permits the inner case to be sealed with tremendous uniform force without heavy bolting.

For additional information, write Byron Jackson Company, 2300-2301 E. Vernon, Los Angeles 45, *referring to* WORLD OIL *item* 220.



Ramsey **FRONT END WINCHES . . . are BETTER**

Lighter • More Compact • More Powerful

Complete line of power take-off driven winches available for ½ to 5 ton trucks.

Ramsey Model 101 Front End Winch Kits available for light trucks having no opening on the transmission for a power take-off. Driven from front of crankshaft by sealed, self-aligning, jaw type clutch. Complete kits including winch frame, cable guide, clutch assembly and cab control available for Jeep, Ford, Chevrolet and International vehicles.

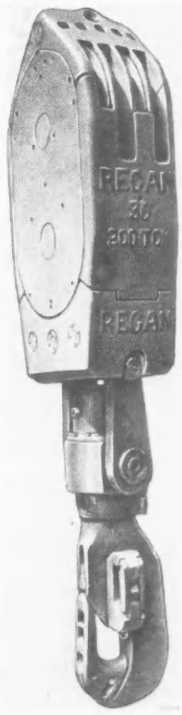
Consult us on **Front End Winch Problems**

RAMSEY WINCH MANUFACTURING CO.

Box 3035 Tulsa, Oklahoma

221–Block and Hook

This item supplements Regan Forge and Engineering Company's data as shown on pages 3661-3684 of Composite Catalog.

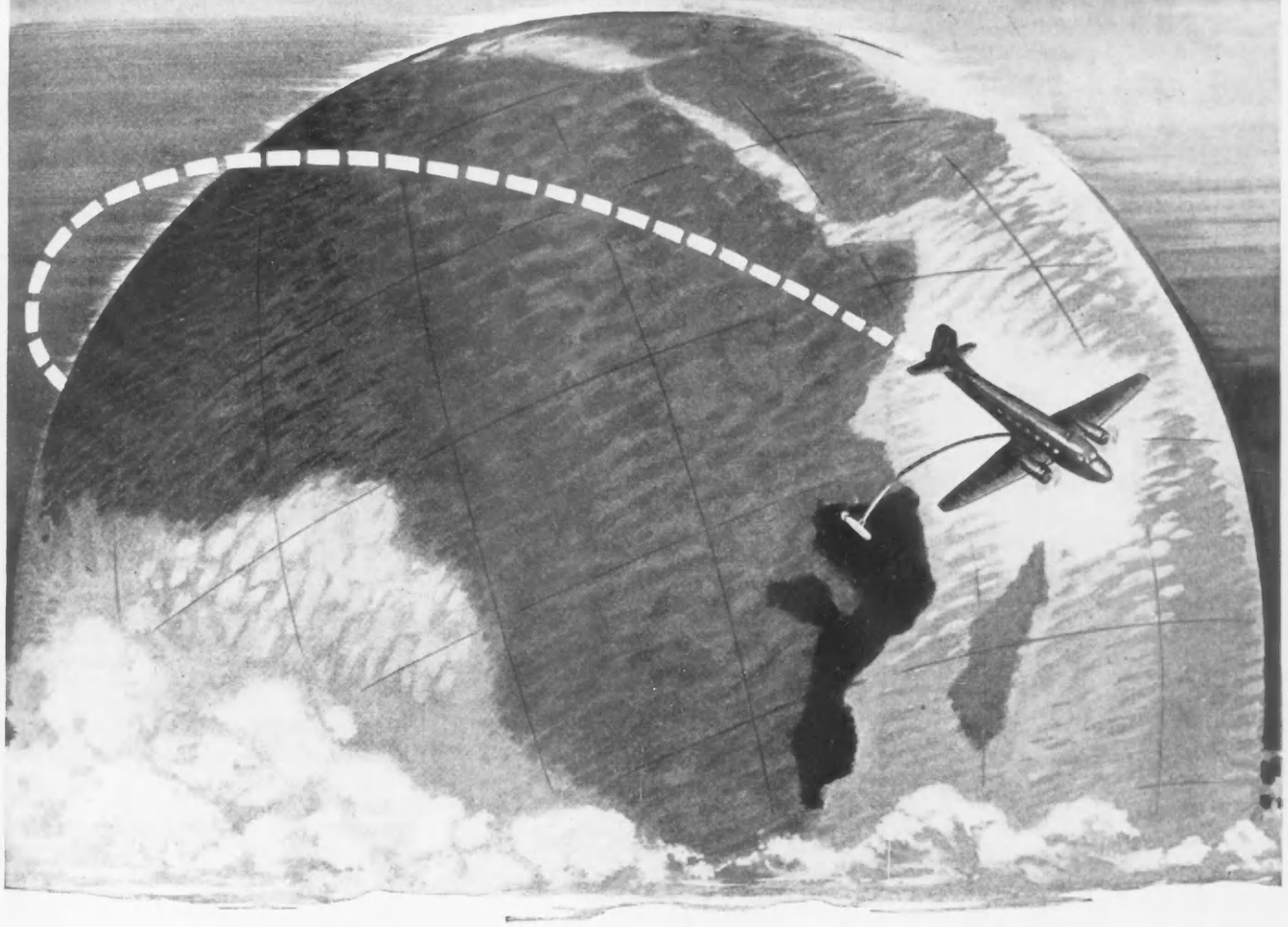


A new traveling block and hook combination is compact, narrow, and has a capacity of 200 tons. The hook is forged alloy steel with special adapter to traveling block which allows the hook to swing at right angle to traveling block, which eliminates the usual rigidness that is noticeable in previous traveling block and hook combinations.

This combination was designed with portable drilling units in mind, a saving of four feet in height having been effected.

For additional information, write Regan Forge and Engineering Company, Box 150, San Pedro, Calif., *referring to* WORLD OIL *item* 221.

SO FAR and yet SO NEAR



Aerial Mapping Speeds Data To Your Conference Room!

Halfway round the world in Portuguese East Africa, Aero Service Corporation is performing another big photo-magnetometer survey.* It moves swiftly and smoothly, backed by close liaison between home office and field . . . by on-the-spot ability to get the job done.

AERO's skilled crew is taking the African job in its stride. Foreign areas and difficult conditions are a commonplace to AERO men. For they have made extensive magnetometer or photographic surveys over the frozen north and tropic jungles—in Alaska, Canada, Newfoundland, Labrador, the Bahamas, Cuba, Haiti, Dominican Republic, Guatemala, El Salvador, Nicaragua, Ecuador, British Guiana, and Venezuela.

Our airborne magnetometer surveys and aerial mapping bring important facts to the conference room, years ahead of schedules for ground studies. Now engineers and geologists can rapidly explore big areas by aerial reconnaissance with the camera and the highly sensitive, precise, airborne magnetometer. Thus with accurate, detailed information management can greatly speed its development planning.

AERO's experience and its skilled personnel are available for your aerial mapping and magnetometer surveys. No place in the world is too far or too difficult for our men and equipment. We will be glad to meet with you to discuss your survey problems and aid your preliminary planning.

Write for our recently published book, "You Can See More From The Air."

*This one for Mozambique-Gulf Oil Co.

AERO
SERVICE CORPORATION
236 E. COURTLAND ST., PHILA. 20, PA.
Oldest Flying Corporation in the World

AERIAL PHOTOGRAPHY • COLOR PHOTOGRAPHY • PRECISE AERIAL MOSAICS • AIRBORNE MAGNETOMETER SURVEYS • PLANIMETRIC MAPS • TOPOGRAPHIC MAPS • RELIEF MODELS

SHORT CUT to LOW COST export CRATING

HECCO

You'll find HECCO's professional export crating service low cost and superior in every way. HECCO will take full responsibility for crating your products and getting them to the proper carrier for shipment.

Experienced personnel, modern equipment and proper plant location make this outstanding service possible.

W. 3-4619 W. 3-4610

HECCO

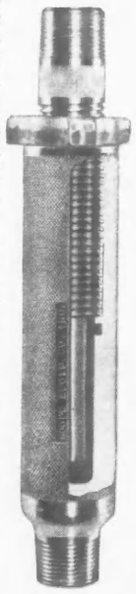
HOUSTON EXPORT CRATING AND CONSTRUCTION COMPANY, INC.

7400-14 Wingate Houston 11, Texas

NEW EQUIPMENT
SUPPLEMENTING COMPOSITE CATALOG

222–Adjustable Nipples

This item supplements Goode Equipment Company's data as shown on page 1421 of Composite Catalog.



A complete range in all popular sizes of adjustable nipples with extension adjustments for ¾-inch to 15 inches, is designed to eliminate cut-to-fit nipples and to facilitate disconnects and reassembly in manifolds, line connections, and hook-ups of all types where liquid, gas, mud or steam are handled.

The nipple consists of an outer barrel reduced and threaded at one end for pipe connection and containing heavy Acme threads inside; a self-sealing packing rubber on the inside of the barrel, an adjusting stem threaded at one end for pipe connection, the center section containing thread corresponding to those in the barrel and the lower end polished to provide a sealing surface for the packing ring. A lock nut prevents the stem loosening after connections are made.

For additional information, write Goode Equipment Company, Houston, *referring to* WORLD OIL *item* 222.

223–New Clevis Grab Hook

This item supplements the Thomas Laughlin Company's data as shown on page 2261 of Composite Catalog.

The Thomas Laughlin Company, Portland, Maine, has marketed a new clevis grab hook which is said to be quickly attached to or detached from the chain and easily switched from job to job.

The clevis grab hook is attached by merely slipping the clevis pin into place and spreading the cotter. This replaces shackling, cold-shutting, cutting, bending and re-welding the chain. No additional fittings of any kind are needed. All parts are drop forged and heat treated for maximum strength and safety. A further safety feature is the special housing which covers the end of this clevis pin, preventing the cotter from catching in the workers' clothing or scratching their hands.

Laughlin Clevis Grab Hooks are available in sizes from ¼ in to ⅝ inch. For additional information write The Thomas Laughlin Company, Portland 6, Maine, *referring to* WORLD OIL *item* 223.

B and W

(Patented and Patents Pending)

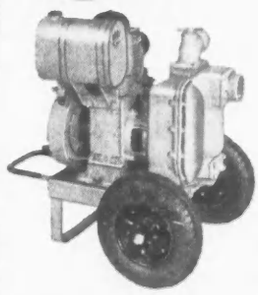
B & W Wall Cleaning Guides help to insure a good primary cement job on your wildcat well .... essential in fully testing all your sands DON'T SQUEEZE! It Can Be Avoided

BRUCE BARKIS — B-W INCORPORATED — KENNETH WRIGHT

Well Completion Specialists

HOUSTON, TEXAS • LONG BEACH, CALIF.

MP PUMPS



3" PIPE SIZE
325 Gallons Per Minute
9 H. P. Wisconsin Motor
ALL BRONZE or CAST IRON

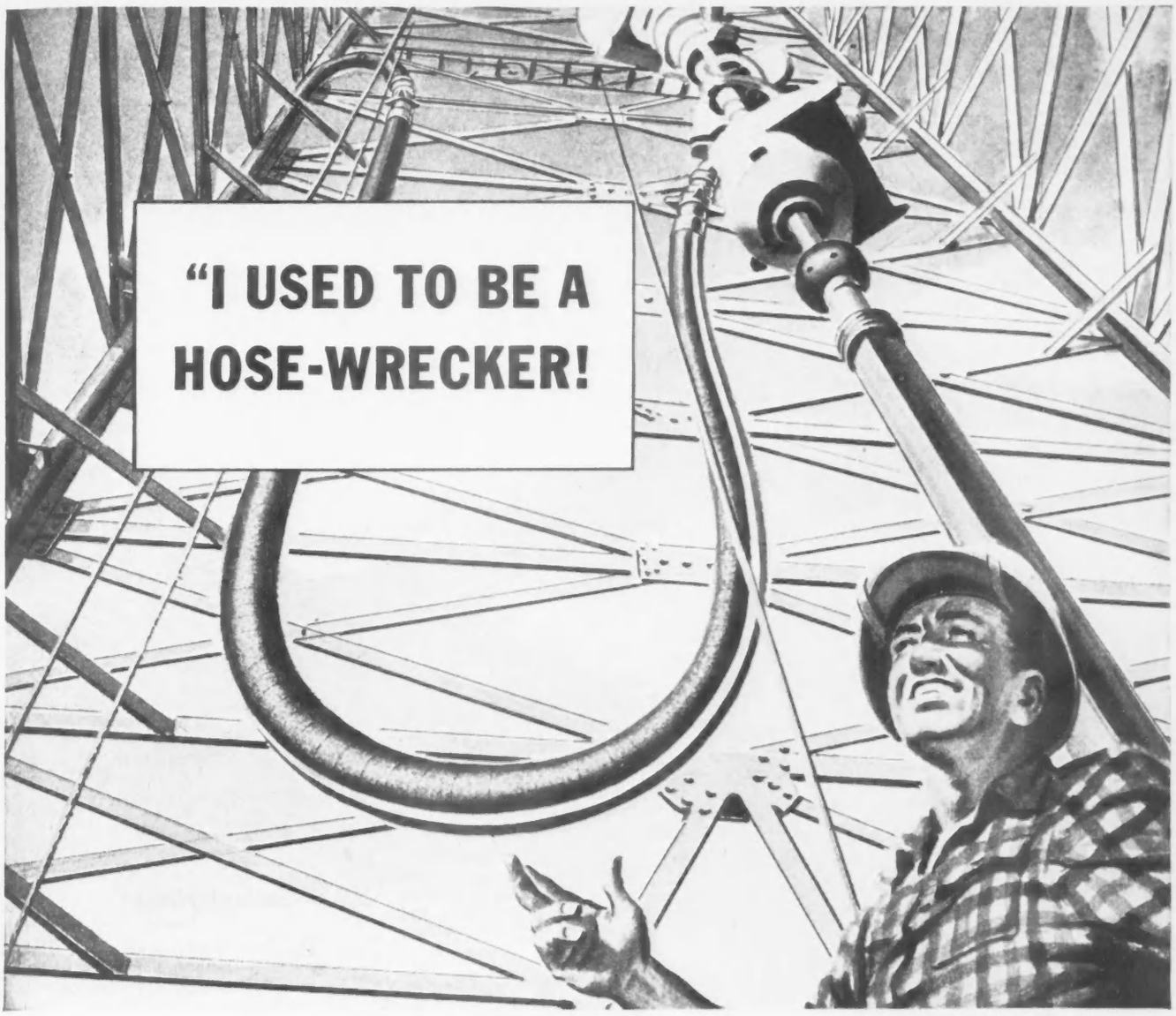
MP FLOMAX "20"
FOR OILFIELD USE

This is the only complete unit that can give both Capacity and Pressure simultaneously.

Designed and built by Engineers specializing exclusively in pumps.

Other sizes available. For information write

Engineered Pumps
MARINE PRODUCTS COMPANY
515 LYCASTE AVENUE DETROIT 14 MICHIGAN



...Until I learned the hose-standpipe formulas"

What he learned was that where rotary hose isn't long enough for mousehole connections there is straining and kinking at the swivel end. And he also learned that when the standpipe is too short the same thing results at the standpipe end.

U. S. Rubber Company Engineers recommend these simple formulas for standard applications:

$$\text{Standpipe height} = \frac{\text{Length of tool string plus 15 feet}}{2}$$

$$\text{Rotary hose length} = \text{Standpipe height plus 10 feet}$$

Drillers will readily see that hose of proper length does not undergo the straining and kinking at the ends that happens with hose that's too short. It will last its full lifetime, prevent shutdowns, reduce drilling costs.

In U. S. Rotary Hose the wire is applied with uniform tension in every ply, and the angle of the wire is scientifically controlled to meet diametric as well as longitudinal stress. This technique of application is called "Unitension" and endows the hose with extra strength demanded by today's terrific pressures in deep-well drilling.

For more information, write to Mechanical Goods Division, United States Rubber Company, 1230 Avenue of the Americas, New York 20, New York.

A product of

U.S.RUBBER
SERVING THROUGH SCIENCE

UNITED STATES
RUBBER COMPANY

FEED WATER ENGINEERING

For high boiler efficiency and low maintenance, investigate our feed water engineering service. Prevents scale formation . . . protects boiler from corrosion . . . prevents caustic embrittlement.

25 Years Successful Experience

GULF ENGINEERING CO., INC.
"Service, Not Promises"
[illegible] INGEBORG ST. HOUSTON, TEXAS
[illegible] PETERS STREET NEW ORLEANS, LA.

STEEL FABRICATION
Custom built...
- MUD PITS
- DOG HOUSES
- WELDED TANKS
- SKIDS
- SUBSTRUCTURES
- TANK TOWERS
- ALL TYPES OF STEEL FABRICATION

Odessa Valve & Machine Co.
P. O. BOX 1068 PHONE 3632
PENWELL & T. P. TRACKS, ODESSA, TEXAS

BARRET

SPECIALIZING IN MAGNETIC SURVEYS

Contracts accepted for domestic and foreign projects, using the most improved instrumental and interpretative technique.

William M. Barret, Inc.
Consulting Geophysicists
GIDDENS-LANE BUILDING
SHREVEPORT, LOUISIANA

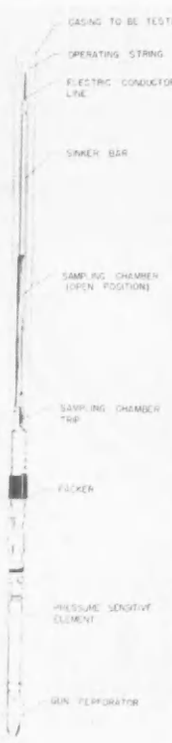
NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

224—McCullough Fluid Sampler

This item supplements McCullough Tool Company data as shown on pages 2557-2584 of Composite Catalog.

An innovation has been added to the McCullough Gun Tester in the form of a fluid sampler. This device provides a sample of the last fluid to come through the valve in the tester before the tester is closed. The sampling device is then brought to the surface where the fluid is observed and tested before starting out of the hole with the testing tool.



When this sampling device is used in conjunction with the McCullough Surface Recording Pressure Bomb equipment, complete information regarding the test is provided within a few minutes.

The manner in which the sampler is employed makes it possible to obtain information in less time, due to the fact that an actual sample of the fluid is made available without requiring any extra time or effort on the part of the operator.

With the new combination of the McCullough Gun Tester with Fluid Sampler and Surface Recording Pressure Bomb equipment sufficient information would be provided before the tester is pulled from the hole. This enables the operator to decide, immediately, whether or not to continue the test while the tester is still in the hole.

For additional information, write McCullough Tool Company, 5820 S. Alameda Street, Los Angeles 11, California, *referring to* WORLD OIL *item* 224.

225—Swivel Hook

This item supplements The Thomas Laughlin Company's data as shown on page 2261 of Composite Catalog.

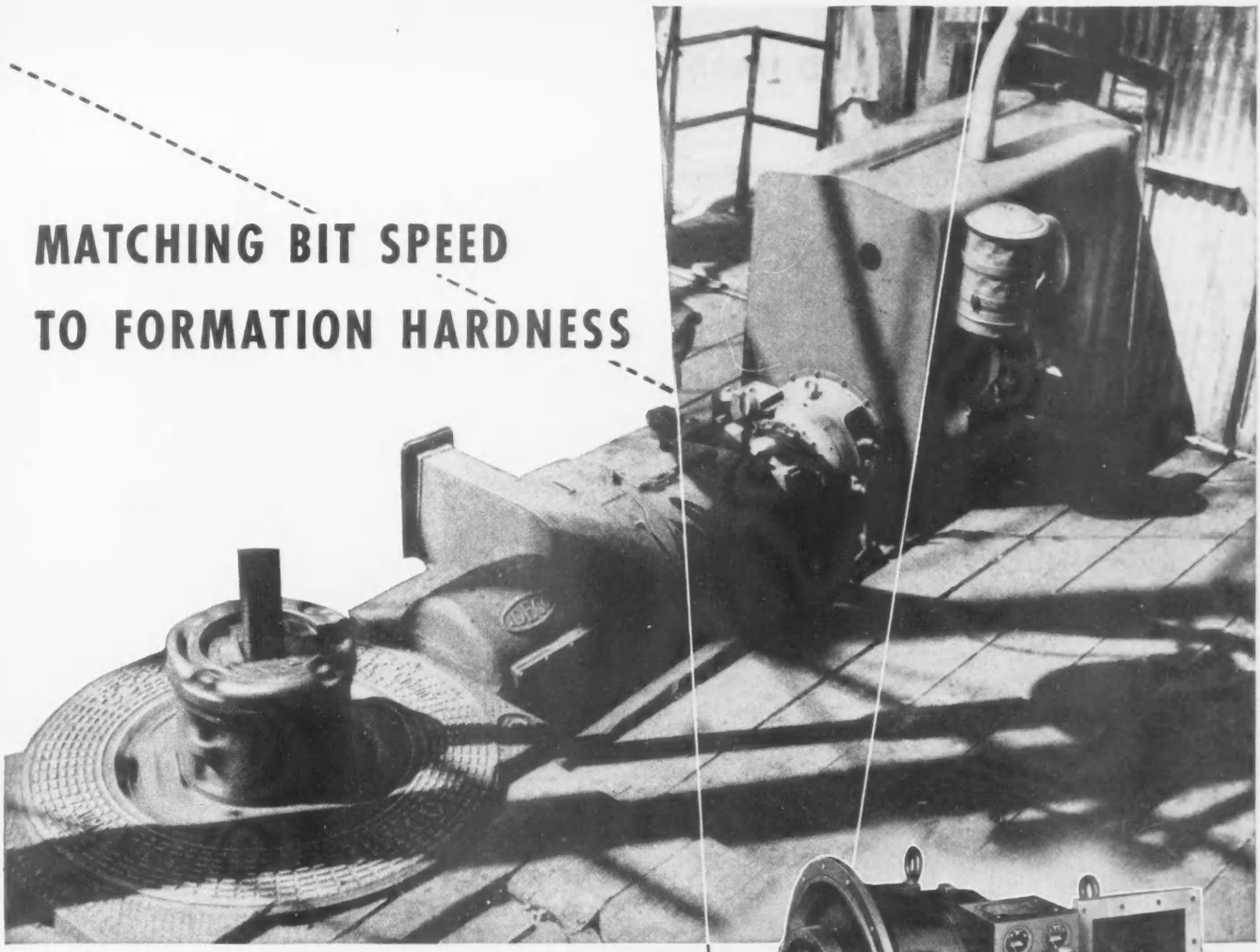
The new replacement swivel hook assembly, made in one-half- and one-ton sizes, is recommended for cranes and hoists, or lashing applications where safety is an important consideration.

The recently developed assembly features the new, improved safety latch on conventional styles of hoist hooks which leaves 80 percent of the regular throat opening, and which will not open until the operator releases the latch with his fingers.

For additional information write The Thomas Laughlin Company, Portland 6, *Maine, referring to* WORLD OIL 225.

PELCO
Welding Saddles
Specify PELCO
IMMEDIATE DELIVERY
OUTLET (OR NOZZLE) SIZES ¼" TO 16"
HEADER (OR LINE) SIZES UP TO 36"
Order Through Your Favorite Supply House
PELICAN WELL TOOL & SUPPLY CO.
P. O. Drawer 1108 Shreveport (84), La.

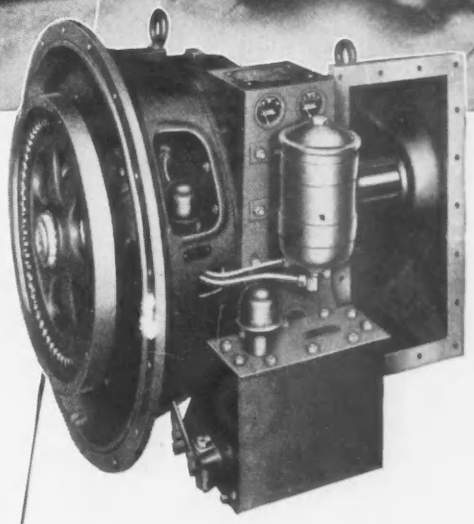
MATCHING BIT SPEED TO FORMATION HARDNESS



Matching drill bit speed with the hardness of the rock formation has been simplified in the oil fields by installing Twin Disc Hydraulic Torque Converters between power units and rotary tables. The use of a Twin Disc Hydraulic Torque Converter makes possible precise adjustment of table speed between the high and low limits of the table drive transmission.

There is no rigid connection in a Twin Disc Hydraulic Torque Converter between driving and driven parts. The power is delivered to the rotary table entirely through fluid mass and motion. Shock loads cannot be transmitted back to the engine, nor can torsional vibrations or other irregularities of power flow reach the rotary table and drill bit. Therefore, a perfectly smooth application of power is assured to govern the speed of the table according to the varying formations through which your drilling may pass.

For full information on the Twin Disc Hydraulic Torque Converter, write the Hydraulic Division, Rockford, Illinois, for Bulletin No. 135-B. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin.



Twin Disc Hydraulic Torque Converter (Lysholm-Smith type).

A Twin Disc Hydraulic Torque Converter transfers power from a Cummins Diesel to the rotary table on this Ideco Hydro-Rotary Drilling Unit. It is operated by the Phillips Petroleum Co., in the TXL Field near Odessa, Texas.

SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918

OTHER NEW AND IMPROVED *Equipment*

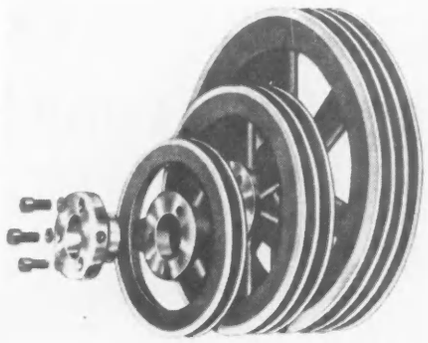
226–*Hub Sheave*

This sheave enables various diameter rims to be mounted on the same hub and hubs of different bore to be mounted on the same size rim.

Heat-treated socket head screws, held securely by lock washers, attached hub and rim together through template drilled holes in the rim web which assures complete interchangeability and quick mounting without special tools. Smaller diameter sheaves utilize fillister head screws.

The hubs are bored to shaft size and keyseated. There are no bushings (which tend to loosen). Perfect fit and concentricity of bore with rim diameter is assured by machining shoulders of the hub and the web face.

Sheave rims are made from light weight, stress free, semi-steel castings which are machined and balanced carefully to assure maximum belt life.



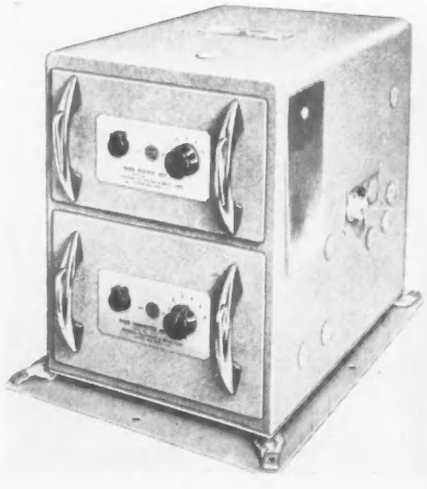
For additional information, write Transmission Machinery Corporation, P. O. Box 7823 Dallas, *referring to* WORLD OIL *item 226.*

227–*FM Two-Way Radio*

Combining compactness with sturdy construction; ease of installation with ready accessibility to all components for inspection and servicing; economy of operation with low maintenance cost, this mobile communications equipment is said to meet every demand placed upon it by the industry. A solution to operational problems is offered by a circuit known as the "Selecto Call" system, which can be supplied upon request. This system permits the central office to contact one or more mobile units without disturbing any of the others. This would not be possible without the "Selecto Call" circuit which thus eliminates the reception of unnecessary calls and other sources of interference.

A single dust-proof, shock mounted metal case 9⅝ inches wide, 11⅞ inches high, and 13½ inches long, houses both the transmitter and receiver. With no connecting cables between units, the space required for installation has been reduced to a minimum.

For additional information, write Federal Telephone & Radio Corporation, Clifton, N. J., *referring to* WORLD OIL *item 227.*

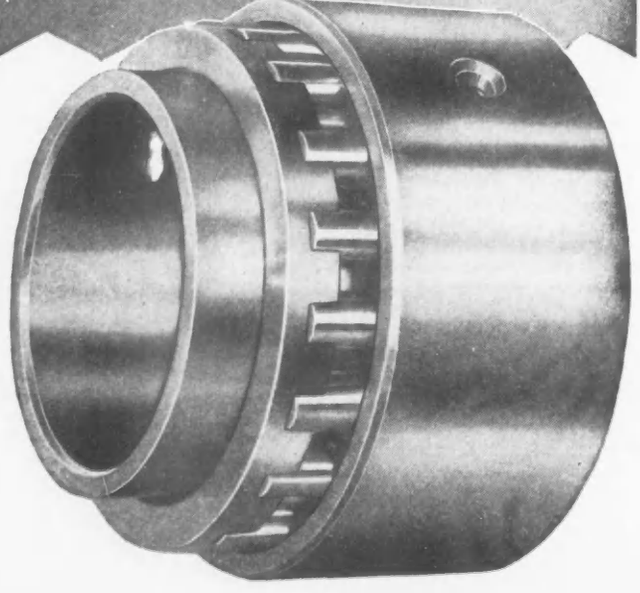


American

"*Extra*" Heavy-Duty

Roller Bearings

for the toughest anti-Friction jobs



Here is a "super" bearing designed especially for super heavy-duty service. Its simple construction, absolute precision and tremendous strength assure smooth, dependable performance in the heaviest machinery under the most difficult operating conditions. Complete technical data furnished without obligation. Write.

AMERICAN ROLLER BEARING CO.

420 Melwood Street Pittsburgh, Pa.

AMERICAN ROLLER BEARINGS

Pacific Coast Office: **1718 S. Flower St., Los Angeles, Calif.**

YOU'LL LIKE IT

You'll be pleased with the performance of the Bethlehem Coupling on your sucker-rod strings. And for good reasons, for the Bethlehem Coupling, like the Bethlehem Sucker Rod, has every requirement for long, economical service.

The coupling regularly furnished is made from either carbon or alloy steel. It is carburized, hardened and ground for protection against well wear, but can also be obtained unhardened. To avoid thread-distortion the coupling is tapped after heat-treatment. And you're assured of a tight fit between the end of the coupling and the rod shoulder, because extra care is taken during manufacture to grind the two coupling faces at right angles to the axis of the threads.

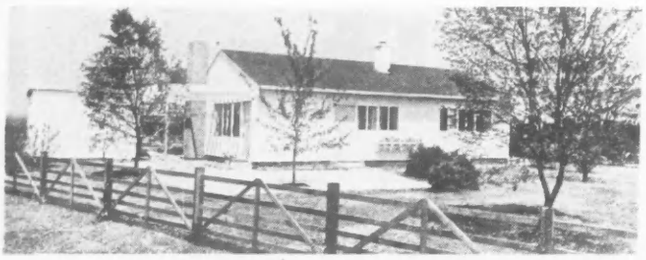
All in all, the Bethlehem Coupling is well worth investigating. Better still, plan to use it on your next pumping job.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

BETHLEHEM STEEL

BETHLEHEM *Sucker Rods*

228–Steel House



The Harman prefabricated steel house is made up of easily-assembled, inter-locked steel framing for walls and roof, rather than whole wall or roof panels such as are found in many prefabricated buildings. The exterior surfaces of the walls and roof are formed by applying steel sheets in tension. The structural steel as well as the sheets which form the side of the home are specially processed to prevent corrosion and received a prime coat of zinc-chromate at the plant.

While the interior is conventionally finished in any desired combination of wallpaper and paint, the house has a strong rigid steel skeleton. The exterior is sheathed in steel and finished with a stucco-appearing paint. It has a large number of windows on all sides.

Steel frame makes possible walls of much thinner construction than normal, resulting in as much as 55 square feet of extra floor space in a three-bedroom house. Scientific use of insulation and air spaces is said to result in a substantial saving in heating bills.

Harman homes are shipped as complete units, eliminating only floor, range, refrigerator, and interior paint, but including the heating system, hot water heater, all plumbing fixtures, fittings and piping, electrical material and fixtures, trim, hardware, exterior paint, kitchen cabinets, and window screens. They are available in two- and three-bedroom models.

For additional information, write William H. Harman Corporation, Wilmington, Del., *referring to* WORLD OIL *item* 228.

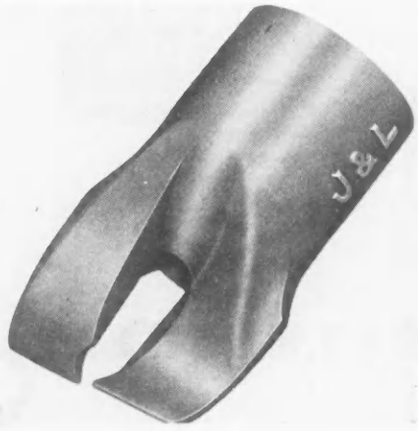
229–Fishtail Bit

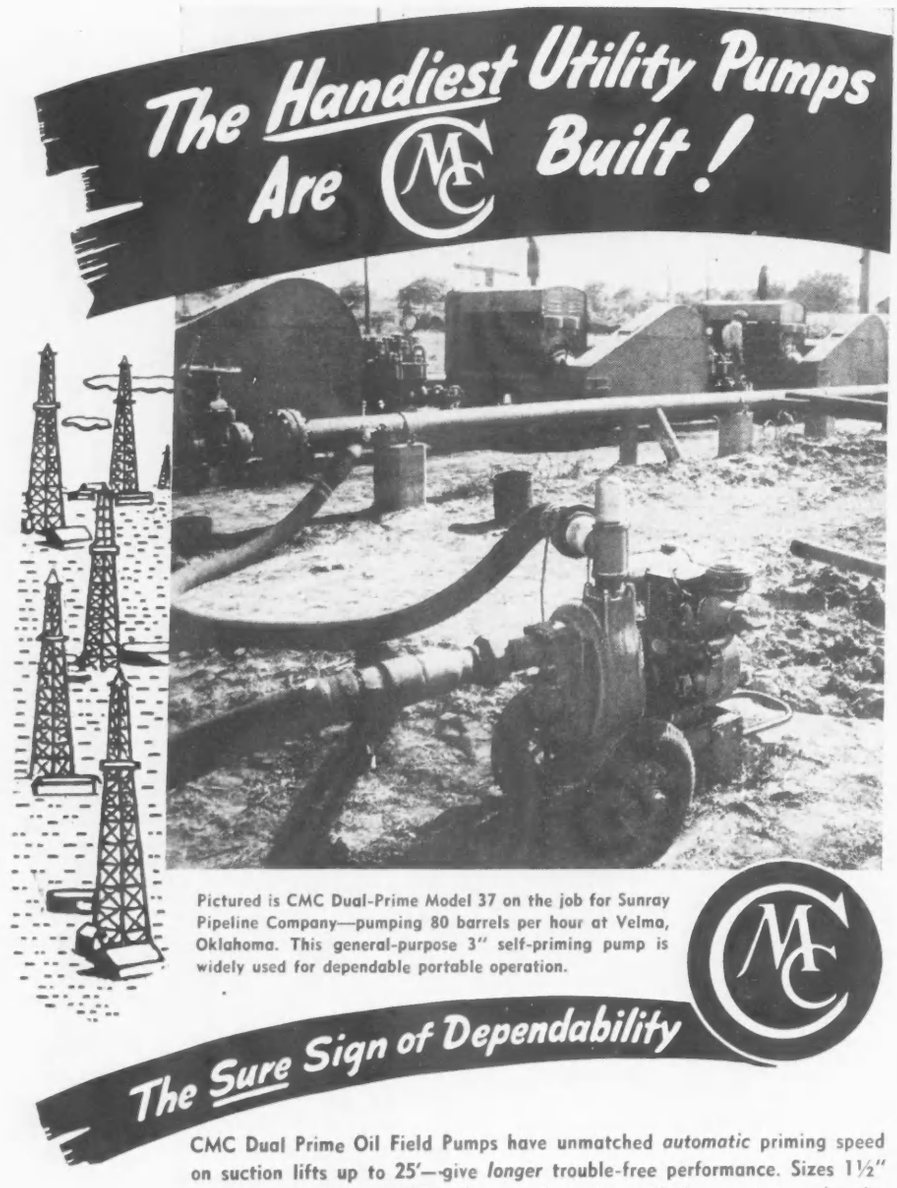
An expendable fishtail bit has been designed for use with Integral joint shot hole casing.

Of particular interest in the design of this bit is the location and size of the water course, which is directed straight down into the formation being drilled. This gives more effective penetration and better cutting action at the blades.

The bit and the integral joint shot hole casing make an efficient team for drilling in soft, moist formations where cave-ins and sloughs are encountered or where "jetting" is necessary. Under field conditions of this type, drilling and casing setting are performed in one efficient operation.

For additional information, write Jones & Laughlin Supply Company, Tulsa, *referring to* WORLD OIL *item* 229.




The Handiest Utility Pumps Are CMC Built!
Pictured is CMC Dual-Prime Model 37 on the job for Sunray Pipeline Company—pumping 80 barrels per hour at Velma, Oklahoma. This general-purpose 3" self-priming pump is widely used for dependable portable operation.
The Sure Sign of Dependability
CMC Dual Prime Oil Field Pumps have unmatched automatic priming speed on suction lifts up to 25'—give longer trouble-free performance. Sizes 1½" to 10" — 3,000 to 200,000 gallons per hour. Every CMC pump is tested under most severe conditions. For greatest economy and the best all-around pump performance insist on CMC. Write today. Our qualified engineers are ready to help you.
CONSTRUCTION MACHINERY CO'S.
WATERLOO, IOWA, U.S.A.
1903 Blodgett St., Houston, Texas
TELEPHONE HADLEY 3988

230–Sucker Rod Grip

A sucker rod grip and hanger have been designed especially for use in portable derricks, but are equally efficient in regular, standard derricks.

The H.D.G. sucker rod grip is made

in one size that will handle all field sizes of rods, thus eliminating the necessity of more than one size grip in the derrick.

As the rods are pulled, the handle in the grip forces the shoe against the rod which then is pressed firmly against the body of the grip. Four friction surfaces against the rod minimize the possibility of rod slippage. However, such slippage as sometimes occurs from excessive wax deposits, can only be to the upset in the rod—an outstanding safety feature which reduces the hazards caused by whipping and/or breaking of the rod string.

For additional information, write H.D.G. Inc., 343 Arbutus Street, Compton, Calif., *referring to* WORLD OIL *item* 230.

231–Composite Nylon-Steel Cable

A special nylon is composited under heat and pressure with wire line to provide the industry with a major improvement in wire rope manufacture. In the process, the nylon flows between the interstices of the strands and wires to form a somewhat homogenous, solidly molded, yet flexible cable.

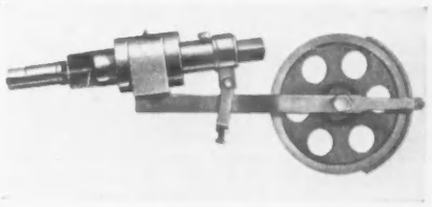
With this new product, which has wide application wherever loads are carried by cables, the resistance to fatigue in wear over pulleys under load has been increased by more than 400 percent. Rusting and corrosion have to a large degree been eliminated. Destruction of ropes from abrasion has been reduced.

For additional information, write Rasmussen Distributing Company, Southern Standard Bldg., Houston 2, *referring to* WORLD OIL *item* 231.

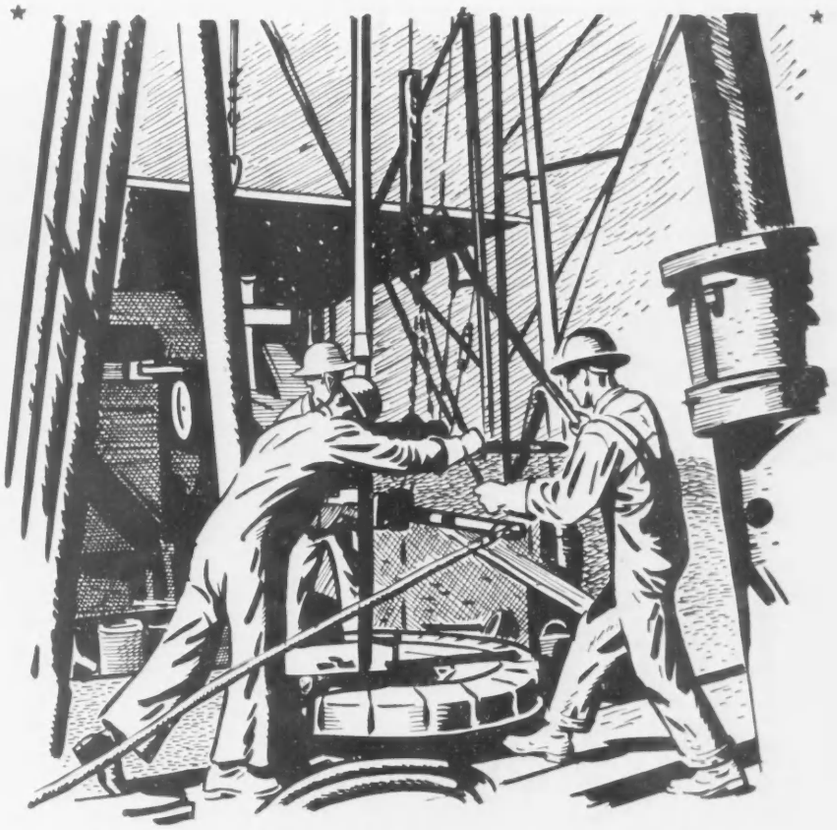
232–Stuffing Box

The Otis wire line stuffing box, heretofore used exclusively by Otis service crews to run and pull sub-surface controls and to perform routine and emergency wire line work, has heavy-duty safety features, including a single-piece extra-strong body; an internal blowout preventer plunger which is used also when it becomes necessary to change packing under pressure; a combination gland nut and oil cup which affords a means to tighten the packing and lubricate the line; and a ten-inch sheave that handles heavier lines with less fatigue and breakage. It can be removed or replaced under pressure.

For additional information, write



Otis Pressure Control, Inc., 6600 Denton Drive, Dallas, *referring to* WORLD OIL *item* 232.



Balancing Today's Needs

A practical working knowledge of the oil industry—combined with ample resources and helpful facilities—have made Republic the choice for oil financing.

CAPITAL AND SURPLUS — $25,000,000

. . . . Largest in the South

REPUBLIC NATIONAL BANK of DALLAS

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

233–Seismic Equipment

An 18-page seismic equipment catalog includes photographs and descriptions of equipment for all types of operations, including reflection seismograph, refraction seismograph, dip shooting, continuous, profile and three dimensional survey, as well as Century Unitized Geophysical equipment, including recording trucks, shooting trucks, panel instruments, the Century Shot Hole drill, etc.

For a copy of this catalog, write Century Geophysical Corporation, 1333 N. Utica, Tulsa, *referring to* WORLD OIL *item* 233.

234–High Pressure Pumps

Data Sheet 62 pictures and describes various types and sizes of high pressure pumps designed and built for pipe line, oil field and refinery service. Two unusual application stories as well as information on pump drives, alleviators, and Kosmos plungers are also included.

as are numerous installation photos of Aldrich pumps in action.

For a copy of this catalog, write The Aldrich Pump Company, Allentown, Penn., *referring to* WORLD OIL *item* 234.

235–Gas Scrubber

A four-page, two-color brochure describes and illustrates the new Gas-Gard line scrubber. Phantom views and cross-sectional drawings show principle of operation and type of construction. Features of the scrubber and specifications are listed.

For a copy of this brochure, write Hoil Engineering Corporation, Tulsa 3, *referring to* WORLD OIL *item* 235.

236–Wire Rope Booklet

Booklet No. 48-1 shows the various processes of manufacturing wire rope from wire rods through wire and rope mills. The story is presented in pictures with short captions in a similar manner to a strip film. Booklet size is 4½ x 5 inches, and contains 56 pages.

For a copy of this booklet, write Macwhyte Company, Kenosha, Wis., *referring to* WORLD OIL *item* 236.

237–Hot Blow-Off Valves

A bulletin on blow-off valves has different types of Everlasting valves for blow-off service presented in tabular form so that the correct selection of valve can be quickly determined for any desired pressure, method of operation, operating conditions, and ASME code requirements. The bulletin is fully illustrated and includes complete dimensions of all units.

For a copy of this bulletin, write Everlasting Valve Company, 49 Fisk Street, Jersey City 5, N. J., *referring to* WORLD OIL *item* 237.

238–Hot Forged Steel Valves

A 16-page catalog describes the full line of Ohio Injector Company's forged steel valves. An entire line of 600-pound forged steel valves in gates, globes, angles and checks with various types of trim are manufactured in screwed, flanged and socket-weld types. The new catalog describes design and construction, materials, ratings and markings.

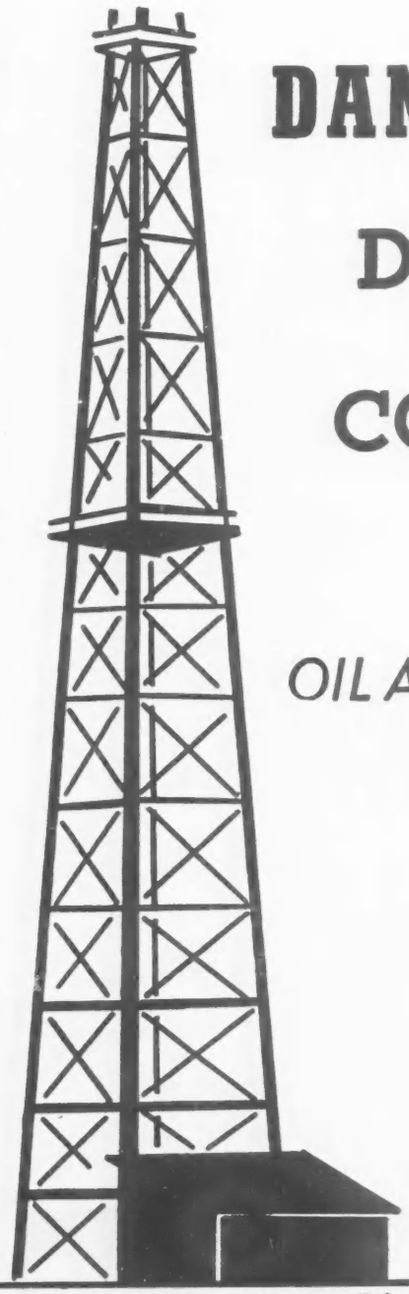
For a copy of this catalog, write Ohio Injector Company, Wadsworth, Ohio, *referring to* WORLD OIL *item* 238.

239–Crown Blocks

A 16-page bulletin, No. 355, superseding bulletins 258 and 259, covers eight types of National Ideal crown blocks and traveling blocks for 300-ton loads and 1¼-inch wire line. The bulletin features and illustrates design of the blocks, particularly the sheave and bearing assembly, and independent mounting of the 48-inch sheaves.

For a copy of this bulletin, write The National Supply Company, Box 899A, Toledo, Ohio, *referring to* WORLD OIL *item* 239.

DAN L. CLARK W. M. AVERILL RUPERT COX



DAN L. CLARK

DRILLING

COMPANY

Drillers of

OIL AND GAS WELLS

POWER AND STEAM RIGS

WILSON BUILDING

CORPUS CHRISTI, TEXAS

Telephones

Local 7746—7747 Long Distance 95

What are your Depth Requirements?

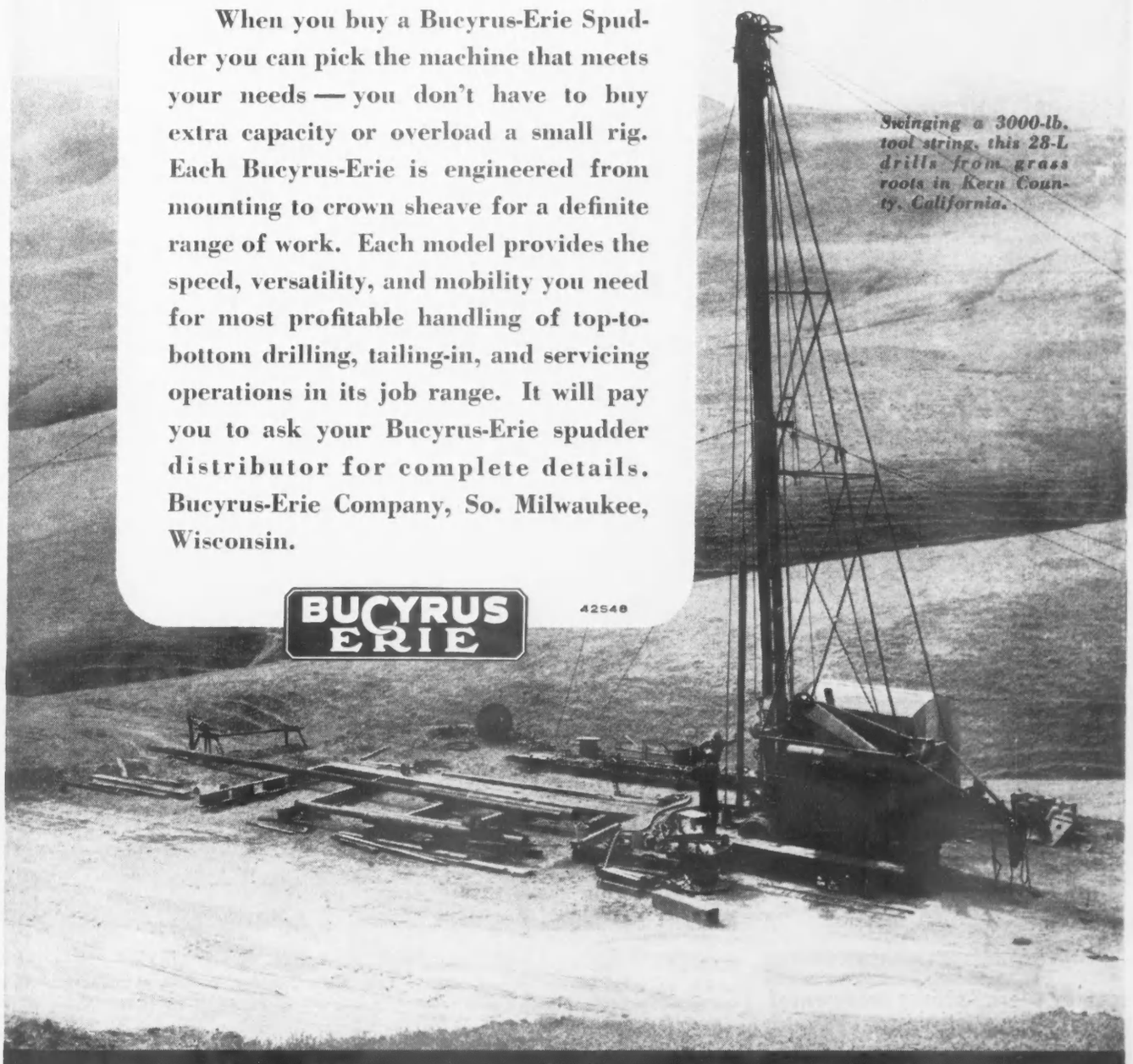
There's a Bucyrus-Erie Spudder for each of these ranges:

DRILLING (ft.)	1500	2500	3500	6000
SERVICING (ft.)	2000	3000	4000	7000
MODEL	24-L	28-L	36-L	48-L

When you buy a Bucyrus-Erie Spudder you can pick the machine that meets your needs — you don't have to buy extra capacity or overload a small rig. Each Bucyrus-Erie is engineered from mounting to crown sheave for a definite range of work. Each model provides the speed, versatility, and mobility you need for most profitable handling of top-to-bottom drilling, tailing-in, and servicing operations in its job range. It will pay you to ask your Bucyrus-Erie spudder distributor for complete details. Bucyrus-Erie Company, So. Milwaukee, Wisconsin.

BUCYRUS ERIE

42548

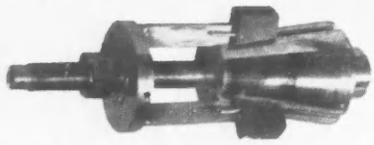


Swinging a 3000-lb. tool string, this 28-L drills from grass roots in Kern County, California.

See Your Bucyrus-Erie Spudder Distributor

NEW HI-TEST STOUT-OWENS LINER-PULLER

The Answer to Liner-Puller Problems

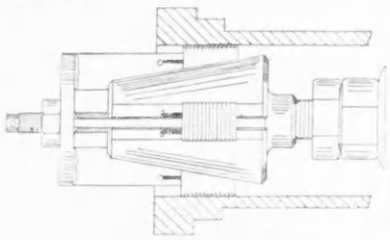


Has Been Tested Thoroughly

A ONE MAN JOB . . IT'S EASY TO OPERATE Does Not Mar Inside of Liner. Small . . . Very Compact.

Weighs 42 pounds . . . does the work of a 100 lb. tool. The easy handling, efficient answer to your liner-puller problems.

CUT-AWAY SECTION SHOWS HOW NEW HI-TEST STOUT-OWENS LINER-PULLER WORKS.



SEE YOUR SUPPLY STORE

Air Mail for Information

Stout-Owens Liner-Puller Co.

225 West 9th, Hutchinson, Kansas

NOW 3 FINE Jimmie Gray COMPOUNDS

INSURE LONGER LIFE FOR TOOL JOINT THREADS

EXCLUSIVE 500 TON SPECIAL

You can always break the joint when you use Jimmie Gray Compounds! Each one is engineered to do certain specified jobs best!

KANT-GALL TOOL JOINT COMPOUND

Both new compounds have the same dependable quality, the same money-back guarantee as the widely used Jimmie Gray 500 TON Special!

LONG-LIFE DRILL COLLAR COMPOUND

SOLD BY SUPPLY STORES EVERYWHERE

STANDARD OIL SALES CO.

BOX 203 HOUSTON, TEXAS
CHARTER 4-5648

Associations

Texas AIME Local Sections Plan Sessions December 16-17

Texas Local Sections of the AIME will conduct a joint technical meeting December 16-17 at the University of Texas. The petroleum engineering faculty and students of the University will be hosts for the meeting, which is alternated annually between the University and Texas A&M College to bring the students into closer contact with engineers in the exploration-drilling-production industry.

The program will be composed of papers secured by each of the five local sections, namely the Gulf Coast Section (Houston, George L. Nye, Chairman); Southwest Texas (Corpus Christi, Henry N. Lyle, Chairman); East Texas (D. W. Akins, Jr., chairman); North Texas (Dallas, Fort Worth, Wichita Falls, Warren J. Jackson, chairman); and Permian Basin (Midland, Odessa, Burton Atkinson, chairman). Dr. H. H. Power, chairman of the University's Petroleum Engineering department, is coordinating the program efforts of the sections. A banquet will climax the meeting.

Offshore Development to Be Discussed At AAPG Session

Attendance of 500 to 1000 is expected at the regional meeting of the American Association of Petroleum Geologists at the Rice Hotel, Houston, December 2-3. The area to be represented at the meeting extends from San Antonio to Lake Charles, La.

Papers will be mostly on salt domes and sediments of the Gulf Coast, with special emphasis on offshore development. George S. Buchanan of Sohio Petroleum Company, Houston, is general chairman for the regional meeting.

Geological and Exploration Problems Are Coast Topics

Twenty six papers, dealing largely with California and Rocky Mountain geological and exploration problems, were presented at the 25th annual meeting of the Pacific sections of the American Association of Petroleum Geologists, Society of Geophysicists and Society of Economic Paleontologists and Mineralogists at the Huntington Hotel in Pasadena, Calif. Between 600 and 700 persons were in attendance.

New officers elected are as follows: AAPG: Clifton W. Johnson, Richfield Oil Corporation, Los Angeles, president; John Kilkenny, Chanslor-Canfield Midway Oil Company, Los Angeles, vice president; Harold Rader, Standard Oil Company of California, Los Angeles, secretary-treasurer.

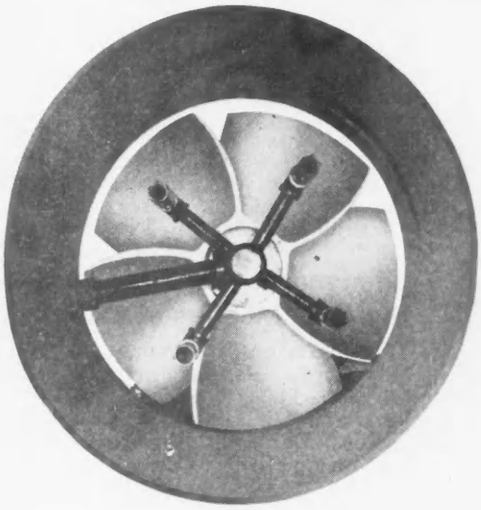
SEG officers: Robert C. Dunlap, Jr., Geophysical Service, Inc., president; J. C. Watterman, Shell Oil Company, Inc., Bakersfield, vice president, northern section; Dr. C. Hewitt Dix, California Institute of Technology, Pasadena, vice president, southern section; William Cortright, Tide Water Associated Oil Company, Bakersfield, secretary-treasurer.

SEPM officers: Aden Hughes, Union Oil Company, Orcutt, president; Ursel Armstrong, Shell Oil Company, Inc., Long Beach, secretary-treasurer.

KANSAS AIME FORMED—Kansas petroleum engineers have set up a Kansas Section, AIME, with V. J. (Mike) Mercier, district engineer, Lane-Wells Company, Wichita, as chairman. Sessions will be held monthly at which Kansas engineers will discuss mutual problems and present appropriate papers. Shown at the installation of officers, left to right, W. F. Brown, district sales engineer, Dowell Incorporated, Wichita, secretary-treasurer; Gene Abernathy, consulting engineer, Eureka, eastern Kansas vice chairman; E. G. Carpenter, Kansas Geological Society, Wichita, presenting chairman's gavel to Chairman Mercier, and Walter Pearson, district engineer, Stanolind Oil and Gas Company, Ellenwood, western Kansas vice chairman.

OWEN FORCED DRAFT--FORCED FEED FIRING SYSTEMS

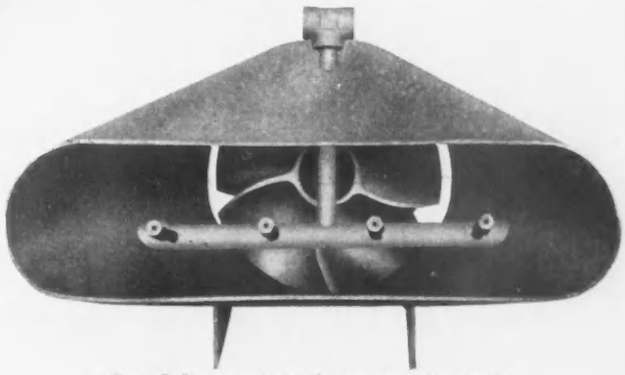
CLOSER CONTROL OF FIRE BOX TEMPERATURES . . . LOW OPERATING COST



Five blade fan on Burner creates a cyclonic draft. Burners are fed by fuel line entering through side of barrel.

Owen Duck's Nests are engineered for most efficient combustion and minimum heat loss.

- Forced draft design eliminates need for stack blowers — provides closer control of fire-box temperatures
- Maintains constant firebox temperatures prevents fluctuations caused by cold drafts
- Improved combustion saves fuel
- Flue warping and fatigue failure minimized—reduces flue scaling
- Forced Feed System assures constant controlled flow of atomized fuel from the burner tips at all times
- Fuel oils of any grade, wet or dry gas may be burned



Type L Burners taper from round fan section to flaring oval mouth. Area at mouth is as great as area at fan, eliminating tendency to choke the draft and create back pressure against fan.

As a result of these exclusive features, Owen Forced Draft Firing Systems greatly increase the working capacity and efficiency of any boiler on which they are installed. Steam turbine driven fans create a cyclonic draft which combines air with the steam-atomized fuel, resulting in improved combustion and lower fuel consumption. Owen Forced Draft Firing Systems can save you money in many ways. We'd like to give you all the facts. ***Write today for mechanical details and specifications.***

OWEN TOOL COMPANY

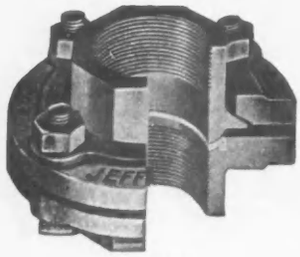
4718 W. 18th Street—Phone V2-4341—HOUSTON, TEXAS

GAS ASSOCIATION ELECTS—New officers of the Independent Natural Gas Association of America chosen at the annual meeting in Tulsa are, left to right, A. B. Harper, president, Arkansas-Oklahoma Gas Company, Fort Smith, Ark., president, succeeding Joseph Bowes, Oklahoma Natural Gas Company, Tulsa; F. W. Peters, treasurer, Oklahoma Natural Gas Company, Tulsa, treasurer; John A. Ferguson, Washington, D. C., executive director and secretary; William H. Wildes, president, Republic Natural Gas Company, second vice president. J. H. Dunn, president, Shamrock Oil and Gas Company, Amarillo, Texas, is first vice president.

Klemme Named Chairman

Don A. Klemme, safety supervisor for Stanolind Oil and Gas Company, Tulsa, has been named general chairman of the National Safety Council's petroleum section for 1948-49. Klemme has served the petroleum section as vice chairman for production, drilling and exploration for the past three years. He succeeds W. I. Kent, safety director of the Magnolia Petroleum Company, Dallas.

Jefferson Malleable Unions



STYLE "B"

JEFFERSON Style "B" three-piece flange union is made with brass-to-iron and iron-to-iron seats. Being made of highly refined AIR FURNACE iron, it assures you of lightweight construction, perfect ball joint, and positive seating arrangement, whether or not in alignment.

★ ★ ★

HYDRAULIC PRESSURE RATING

Sizes	Test Pres.	O. W. G.	S.W.P.-550 Deg.
½" thru 4"	2000#	800#	250#
5" and 6"	1200#	500#	250#
8" and 10"	1000#	400#	250#

Malleable iron used in all JEFFERSON unions meets ASTM-4733, Grade 35018—M. T. 53000 Lbs., giving 75%-more elongation 50%-more impact value and is 30%-stronger than cupola malleable iron.

Obtainable through your jobber

Jefferson Union Company, Inc.

691 West 26th St.,
New York 1, New York

71 Gooding St.,
Lockport, New York

31 Fletcher St.,
Lexington, Mass.

James Tanham Elected Board Chairman of Safety Council

James Tanham has been elected chairman of the board of the National Safety Council. Tanham, vice president of The Texas Company, has been active in the field of industrial relations for the past several years and during the war served as chairman of the Industry Members of the War Labor Board. He is also chairman of the executive committee and member of the board or directors of the Greater New York Safety Council.

James Tanham

Maintenance to Be Discussed At NGAA Meeting in Amarillo

Plant operation and maintenance problems are due for discussion at the Panhandle-Plains regional meeting of the Natural Gasoline Association of America, December 10, in the Herring Hotel, Amarillo, Texas, it was announced by the program committee headed by Ervin F. Glasgow, Phillips Petroleum Company, Phillips, Texas.

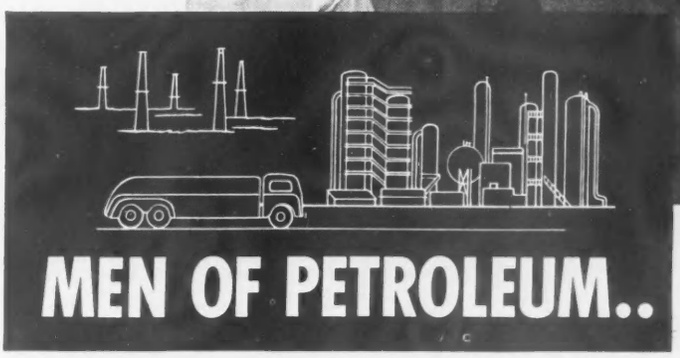
The one-day meeting will also feature addresses on industry trends by NGAA President C. R. Williams, The Chicago Corporation, Corpus Christi; Col. Ernest O. Thompson, chairman, Texas Railroad Commission, Austin; and L. R. Hagy, Hagy, Harrington & Marsh, Mayor of Amarillo.

Other papers on the program include: "Dehydration of Natural Gas," E. G. Hammerschmidt, Amarillo; "Heat Exchanger Maintenance," J. S. Conners and L. J. Webber, Phillips Petroleum Company, Phillips, Texas; "Meters, All Kinds," C. C. Clover, Westcott & Greis, Inc., Tulsa; "Increasing Gas Pumping Capacity Through Use of Compressor Cylinder Clearance Pockets," W. R. Barrett, Phillips Petroleum Company, Bartlesville, Okla.; "Safety Practices in Natural Gasoline Plants" (the combined opinions of five companies), presented by C. L. Ritter, Continental Oil Company, Ponca City, Okla.; "Practical Fractionation," Dr. Frank Fowler, University of Oklahoma, Norman, Oklahoma; and "Crude Oil Distillation," an animated sound film by Shell Petroleum Company, Inc.

Pacific Committee Merged With Western Oil Group

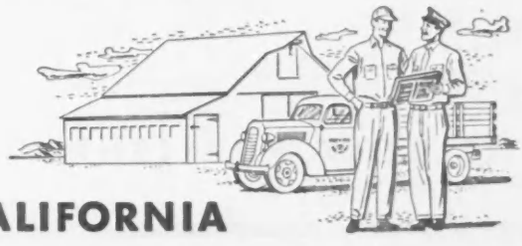
Merger of the Pacific Coast Petroleum Industries Committee and its functions into the Western Oil and Gas Association was approved by the association's board of directors.

The merger is being effected in the interests of eliminating duplications in overhead and effecting a better coordination of the industry's activities with respect to highway finances, gasoline taxes, municipal ordinances and related matters.



MEN OF PETROLEUM..

AREA SALESMAN... Better known as "The Standard Man" to the thousands of people he serves. Coming in direct contact with the farmer, rancher, storekeeper, he is more friend than salesman—a friend who shows anyone who uses petroleum . . . in any form . . . how to save time, automobiles, machinery or livestock. But the area salesman's greatest service is bringing the achievements of the most modern research laboratories to his area...that his customers may have the benefits of the multitude of human and technical benefits that flow from petroleum.



STANDARD OIL COMPANY OF CALIFORNIA

Alberta Minister of Mines To Speak At Compact Session

N. E. Tanner, minister of lands and mines, Province of Alberta, Canada, will speak at the Interstate Oil Compact Commission's annual meeting in Wichita, Kansas, December 9-11.

Tanner will discuss oil and gas developments in Canada, analyzing present activity and potentially productive areas, reviewing the Leduc field, and emphasizing conservation work.

I. N. McKinnon, chairman of Alberta's Petroleum and Natural Gas Conservation Board, also expects to attend the Wichita meeting.

Theme of the Wichita meeting will be conservation of natural gas. Various phases of the subject will be discussed by speakers of nation-wide reputation.

Warren Petroleum Official Heads NGAA Committee

Howard Montgomery, manager of terminals for Warren Petroleum Corporation, Houston, has been appointed chairman of the Technical Committee of the Natural Gasoline Association of America, according to NGAA President C. R. Williams, The Chicago Corporation, Corpus Christi. Vice chairman of the committee is Joe F. Wood, research engineer, Skelly Oil Company, Pawhuska, Okla.

THE OIL MAN'S CALENDAR

NOV. 28 to DEC. 3	American Society of Mechanical Engineers, Annual Meeting, Hotels Pennsylvania and New Yorker, New York.
29 to DEC. 4	National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York.
DEC. 2- 3	Petroleum Electric Power Association, Annual Meeting, Biltmore Hotel, Oklahoma City.
2- 3	American Association of Petroleum Geologists, Rice Hotel, Houston.
9-11	Interstate Oil Compact Commission, Allis Hotel, Wichita, Kansas.
16-17	Local Sections of AIME, University of Texas.
30	Petroleum Motor Transport Association of Oklahoma, Mayo Hotel, Tulsa.
JAN., 1949 10-14	Society of Automotive Engineers, Annual Meeting, Book-Cadillac Hotel, Detroit.
17-18	Compressed Gas Association, Annual Meeting, Waldorf-Astoria, New York.
MAR. 9-11	American Petroleum Institute, Southwestern District Meeting, Galvez Hotel, Galveston, Texas.
23-25	American Petroleum Institute, Mid-Continent District Meeting, Mayo Hotel, Tulsa.
24-25	New England Gas Association, Boston, Hotel Statler.
28-30	American Society of Automotive Engineers, Transportation Division, Statler Hotel, Cleveland.
APRIL 4- 6	American Gas Association, Distribution Motor Vehicle and Corrosion Conference, Netherlands-Plaza Hotel, Cincinnati.
11-13	National Association of Corrosion Engineers, Netherlands-Plaza Hotel, Cincinnati.
12-14	Southwestern Gas Measurement Short Course, College of Engineering, University of Oklahoma, Norman.
13-15	National Petroleum Association, Hotel Traymore, Atlantic City, N. J.
20-22	National Gasoline Association of America, Annual Convention, Texas Hotel, Fort Worth.
20-22	Southern Gas Association, Convention, Beuna Vista Hotel, Biloxi.
27-29	American Petroleum Institute, Eastern District Meeting, William Penn Hotel, Pittsburgh.
MAY 2- 4	Independent Petroleum Association of America, Mid-Year Directors Meeting, New Orleans, La.
9-10	American Gas Association, Natural-Gas Department, Spring Meeting, French Lick Springs Hotel, French Lick, Ind.
12-13	American Petroleum Institute, Division of Production, Pacific Coast District Meeting, Biltmore Hotel, Los Angeles.
26-27	American Petroleum Institute, Rocky Mountain District, Gladstone Hotel, Casper, Wyoming.

Nomads Chapter monthly meetings: **Los Angeles**, second Wednesday, Jonathan Club. B. M. Landis, Secretary. **Houston**, second Monday, Houston Club, Harry E. Estes, Secretary, Telephone Charter 4-7611. **Dallas**, L. A. Little, Secretary, Telephone Justin 8-1726. **Tulsa**, third Wednesday, Hotel Tulsa, Anthony Gibbon, Secretary, Telephone 3-1844. **New York**, first Monday, Louis Sherry's, Norris Boulden, Secretary, Telephone WIcersham 2-1311, extension 260.

OPPORTUNITY FOR

Experienced Oil Field Service Personnel

Field Superintendents
Sales Engineers
Perforator Operators

Outstanding opportunities to become associated with a young and progressive organization which pioneered the development of the jet process of casing perforation and other applications of the jet method. Welex Jet Services, Inc., is the owner and licensor of these processes throughout the world. We are now expanding our field service division and are opening several new stations to better serve the oil industry.

Applications for employment from qualified oil field personnel are solicited. Those accepted will enjoy the security of key positions now and rapid advancement in our expanding field service division.

Write or phone Welex Jet Services, Inc., 3909 Hemphill St. (Phone 4-3247), Fort Worth 9, Texas.

GAS ENGINEERS' HANDBOOK

Prepared by Gas Engineers' Handbook Committee of The Pacific Coast Gas Association, San Francisco, California

Here is a comprehensive and authoritative manual, giving the gas engineer a reference tool comparable to the standard handbooks in other fields of engineering. Now in one volume are brought together a great many of the constants and formulas which the gas engineer uses most frequently in his work. Every phase of the field is covered, including fundamental mathematics; properties of materials, liquids, and gases; heat and combustion; production; testing and measurement; transmission and distribution; and utilization, both industrial and domestic.

For the various constants, latest figures from recognized sources have been used. New material is included on long transmission lines, on the design of distribution systems, on the production and utilization of natural gas and on the production and use of the so-called "liquid" gases. That the effort to make this book useful and acceptable to engineers throughout the industry has been successful is indicated in the endorsement of the Directors of the American Gas Association which it bears, as a "valuable reference book for gas engineers."

MAIN SECTION HEADINGS

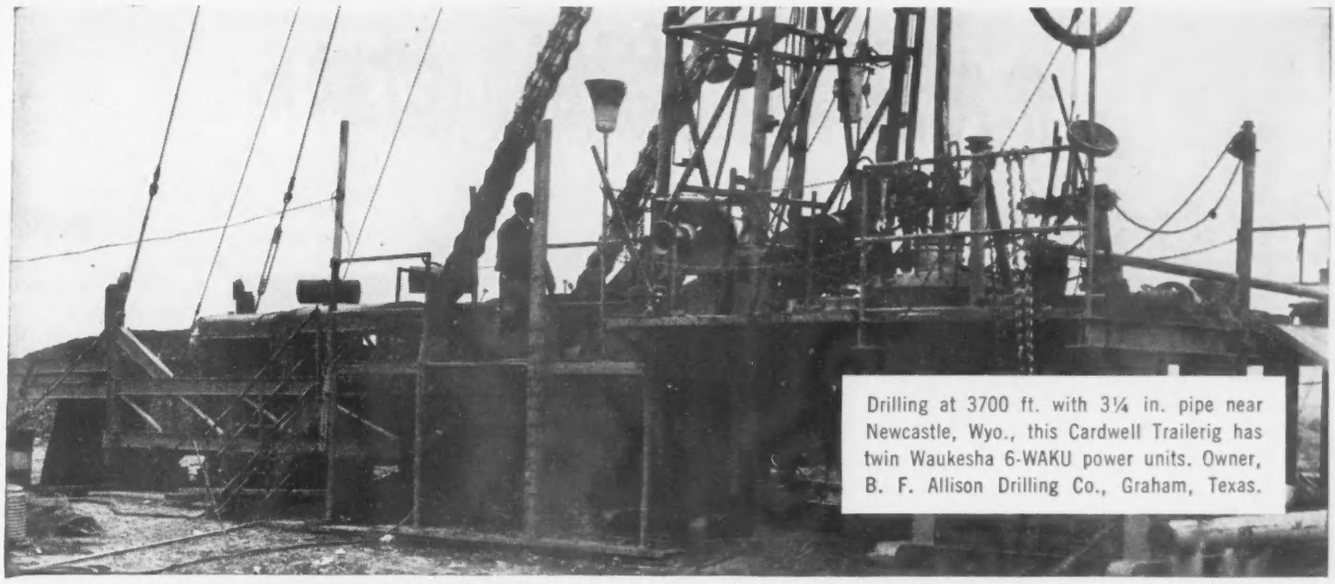
1. Mathematical and Conversion Tables and Graphs
2. Properties of Elements, Common Substances, and Engineering Materials
3. Properties of Gases, Air, Steam, and Water
4. Fuels and Combustion
5. Production of Gas
6. Testing and Measurement
7. Transmission and Distribution
8. Utilization of Gas

1008 pages, 6 x 9, 344 illustrations and graphs, 466 tables, $9.00

SEND ORDERS TO

THE GULF PUBLISHING COMPANY

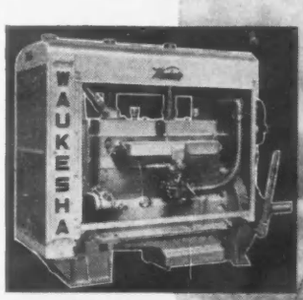
3301 BUFFALO DRIVE **BOX 2608** **HOUSTON, TEXAS**



Drilling at 3700 ft. with 3¼ in. pipe near Newcastle, Wyo., this Cardwell Trailerig has twin Waukesha 6-WAKU power units. Owner, B. F. Allison Drilling Co., Graham, Texas.

POWER plus PORTABILITY

The *Cardwell* TRAILERIG is modern, complete, compact! entirely self-contained! portability plus! Recommended by its makers for drilling to 5000 ft. with 4½ in. drill pipe and workover jobs to 10,000 ft. Equipped with 90 ft. telescoping mast and mud pump drive. Double drum drawworks has twin Waukesha 6-WAKU Power Units, each one putting out better than 200 hp. at the peaks. Air disc clutches in both ends of drum provide high and low drum speeds operated by single lever. All necessary hoisting, mud pump and table speeds available simultaneously. Waukesha Super-Duty Sixes for dependable drilling. Get Bulletin 1139.

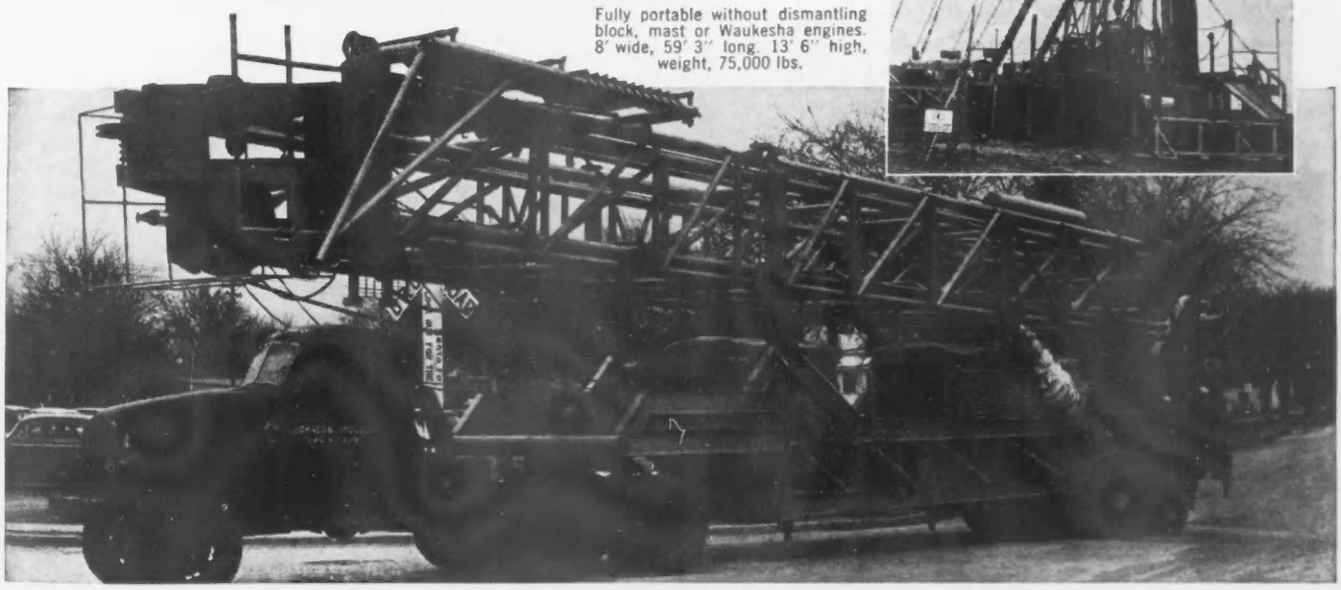


Model 6-WAKU POWER UNIT
six cyl. 6¼ in. x 6½ in., 1197 cu. in., 213 hp. max. at 1300 rpm., burns gas or gasoline.

WAUKESHA MOTOR COMPANY, WAUKESHA, WIS.
NEW YORK • TULSA • LOS ANGELES

WAUKESHA

Fully portable without dismantling block, mast or Waukesha engines. 8′ wide, 59′ 3″ long. 13′ 6″ high, weight, 75,000 lbs.



Men in the Industry NEWS

Victor H. Bowman, manager of the Products Supply and Contract departments for The Pure Oil Company, has also become general manager of crude oil purchasing and product supply. He has been with Pure 23 years. **Joseph W. Meehan,** made vice president of Pure Transportation Company, will also supervise the operations of the company's other pipe line subsidiaries. **Anker L. Christy** will continue as transportation engineer and will also be in charge of project planning and liaison work in transportation and supply. **Walter F. Hagestad** becomes general manager of the Marine and Terminal divisions. **Fred Steingraber** has been placed in charge of the company's Terminal division.

Bottom Water is a costly profit leak

Eagle Lead Wool

***stops* Bottom Water!**

You rule out the risk of oil-wasting bottom water shutdowns when you tamp Eagle Lead Wool in the hole. This finely stranded, non-corrosive metallic wool makes a water-tight plug that seals every crack and crevice. Comes in convenient 50-pound sacks—easy to place in special cartridge-shaped Eagle Wire Containers sized to fit all casings. Order through your jobber today.

These 3 Eagle Bearing Metals meet most requirements

Eagle Dreadnaught—for extreme speed and heavy-duty conditions.

Eagle Outlasta—for medium speed and average-load conditions.

Eagle Durable—for low speed and light-duty conditions.

EAGLE LEAD WOOL

Seals off Bottom Water—keeps 'em flowing!

THE EAGLE-PICHER COMPANY

EAGLE Since EP 1843 PICHER

Chicago • East St. Louis
Cincinnati • Dallas
Kansas City

L. T. Barrow was elected chairman of the board of directors of Humble Oil & Refining Company.

L. T. Barrow

He has been with the company since 1924, a director since 1937, and vice president since 1938. Barrow was born in Manor, Travis County, Texas, and was educated in the public schools of Austin. His studies at the University of Texas were interrupted by the first World War. He served in the Air Corps from October, 1917, to March, 1919. He returned to the University of Texas, where he specialized in geology and received his Bachelor of Arts degree in 1921 and his Masters degree in 1923. He served as an instructor of geology at the University of Texas for two years prior to joining Humble as a division geologist in 1924. Barrow organized Humble's geologic work in the San Antonio division in the years immediately after joining the company. He was appointed chief geologist in 1929 and occupied that position until February 1937 when he was elected to the board of directors. Since 1937 he has been the director in charge of the company's exploration activities.

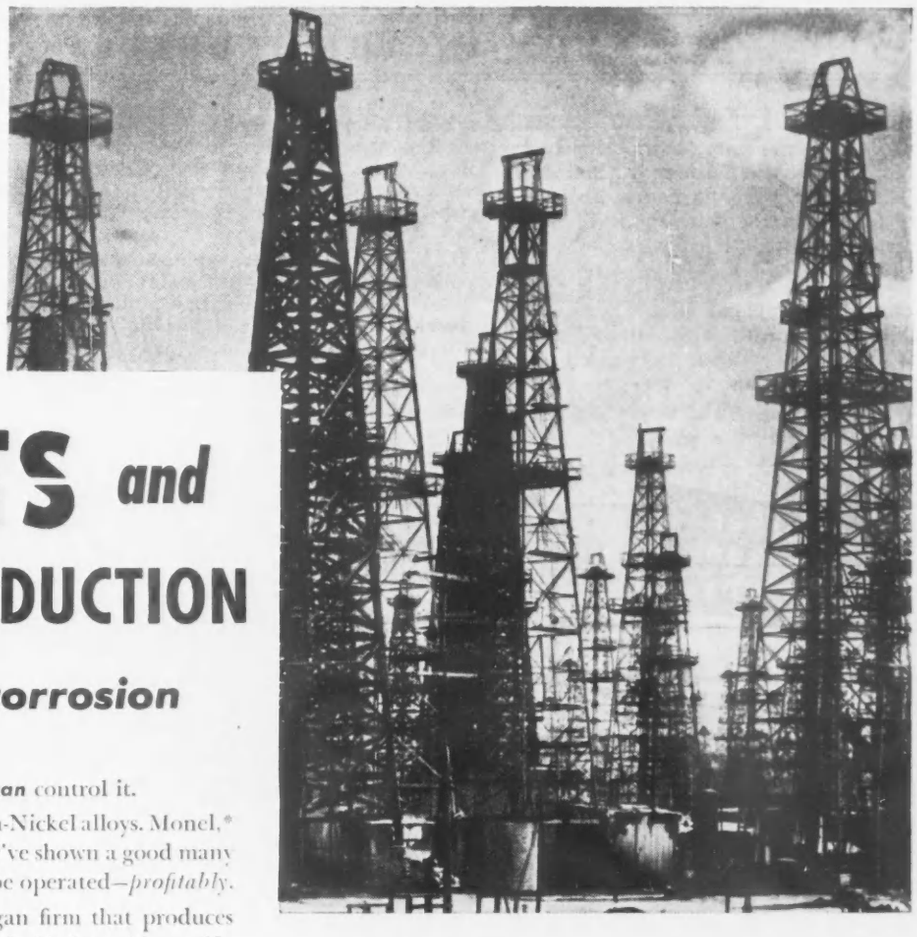
Walter T. Wells, chairman of the board of Lane-Wells Company, has been named to the board of trustees of West Coast University.

W. F. (Frank) Jones, secretary of the California Chapter, American Association of Oil Well Drilling Contractors, has joined the firm of Stansbury, Inc. This company is headed by **M. H. (Curly) Stansbury,** and his brother, **Bert Stansbury,** drilling contractors with offices at Bakersfield. For the present, at least, Jones is to continue with the AAODC.

Rex V. Phelps and **Sam I. Hulse** were elected directors of Warren Maritime Corporation, wholly-owned subsidiary of Warren Petroleum Corporation.

Gordon Watts, assistant county attorney for Oklahoma County, has resigned to join the legal staff of Shell Oil Company, Inc., at Tulsa.

Carl H. McAlister, formerly chief geophysicist for Sunray Oil Corporation, has opened a consulting geophysical office in Tulsa and will specialize in review and reinterpretation of seismic data in the Mid-Continent and Gulf Coast areas.



How YOU can

CUT COSTS and INCREASE PRODUCTION

...by controlling corrosion

You can't stop corrosion. But you ***can*** control it.

Install equipment made with high-Nickel alloys. Monel,* for example. Or "K"* Monel. They've shown a good many producers that corrosive wells can be operated—*profitably*.

Take the experience of a Michigan firm that produces from the Sylvania formation a chemical brine with specific gravity of 1.28. At a depth of 2,400 feet, the pump they were using just didn't stand up. *But trouble ended when they installed a Reda pump equipped with a "K" Monel shaft and Ni-Resist diffusers.*

Then consider the story of this well in Louisiana. It had *plenty* of oil below the surface—but would only make gas on a 1/8" surface choke with 3,000 pounds pressure. Freezing of surface flow lines and connections was frequent. The allowable couldn't be produced.

After the operator installed an Otis Removable Bottom Hole Regulator made of "K" Monel, surface pressure dropped to 1,350 psi. Freezing stopped. Gas-oil ratio was cut to a point where almost no oil was wasted. The regulator stayed in the tube 57 months, produced 869,839 barrels before it was pulled for inspection. *It was found in first-class condition.*

Of course, corrosion resistance is only one quality that contributes to the dependability of equipment like this. Extra strength, hardness, toughness or resistance to wear and abrasion may also be vital. *In high-Nickel alloys, you get the combination of properties you need.* Through years of use in the toughest areas of the mid-continent district, Monel and "K" Monel have proved especially well adapted to combat harsh conditions.

Monel, in addition to being rustproof and highly resistant to sour crudes, withstands the cutting action of high-pressure gas, provides unusually good resistance to erosion and abrasion by entrained solids. **"K" Monel** brings you those same characteristics *plus* extra strength and hardness. It is non-magnetic; by heat treatment its tensile strength can be developed to 140-170,000 psi, its hardness to 265-320 Brinell.

Both Monel and "K" Monel are used for parts subject to alternating stresses in the presence of corrosives. Their retention of good fatigue strength is particularly evident in extended equipment life.

The full story of how you can put these and other INCO Nickel Alloys to work for you is contained in our new, illustrated booklet, *Controlling Corrosion in Petroleum Production Equipment.* It brings you typical performance and service stories of Nickel Alloys in a variety of corrosive uses. It discusses the important factors in reducing maintenance and replacement costs. There are sections dealing with exploration and drilling, pumping, and gas control.

The booklet tells, too, how you can get free technical advice on the selection of materials for severe service, and contains a listing of valuable Technical Bulletins that are available to you on request. Write for your copy—*now*. We'll get it into the next outgoing mail. *Reg. U. S. Pat. Off.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

EMBLEM OF SERVICE
INCO
TRADE MARK

MONEL..."K" MONEL...

Your partners in PROGRESS

Jack W. Copas, Tulsa, and **C. R. Sullivan,** Oklahoma City, both recently resigned from the Amerada Petroleum Corporation, have formed a geological consulting partnership and will maintain offices in both cities.

»

John V. Melton has resigned from the Land department, The Atlantic Refining Company, Tulsa, to become land man of the Oklahoma division, British-American Oil Producing Company, with offices at Oklahoma City.

Fred C. Beleau has been named division drilling superintendent at Casper, Wyo., for Stanolind Oil and Gas Company, following his transfer from Alvin, Texas, where he was district superintendent.

»

H. J. (Hank) Bourke, superintendent of Warren Petroleum Corporation's Fairbanks, Texas, gasoline plant for eight years, has been made superintendent of the company's newest and largest gasoline plant at Maysville, Okla. He will be succeeded by **Everitt Almond,** former superintendent of Warren's Maud, Okla., plant.

Edmond M. Wagner, California petroleum and mechanical engineer, was presented with a presidential citation "for an outstanding contribution to the work of the Office of Scientific Research and Development during World War II." Wagner made his early contribution to the war effort in the development of steel cartridge cases and manufacturing methods for the Ordnance Department, U. S. Army. He then laid out a plant, supervised tool design, selected equipment and supervised production of gun mounts for light tanks. His next job was consulting engineer of the Ordnance Department, and later he was made chief of the engineering office, National Defense Research Committee.

Edmond M. Wagner

»

F. E. Stanley, oil pipe line executive and Tulsa civic leader, has been elected to the board of directors of the Tulsa Federal Savings and Loan Association. Stanley is president of the Midwestern Contractors, Inc. and Midwestern Drillers, Inc.

»

J. J. McClelland has been made manager of the new Columbus district of The Ohio Oil Company, which will serve as headquarters for operations in Ohio, Pennsylvania, Virginia, West Virginia, eastern Kentucky and eastern Tennessee. McClelland is a veteran of 29 years in the company's production department. **H. G. Walter** has been appointed district geologist. The new office will be in the Peters Building, Columbus.

»

Silas B. Brown has joined General Petroleum Corporation's offices at Durango, Calif., as geologist, representing the company's exploration work in western Wyoming, Utah and southwestern Colorado. Brown goes to General Petroleum from the U. S. Geologic Survey at Phoenix. He previously had two years service in Colombia with an affiliate of the company. **Lesh C. Forrest** has been promoted to district geologist for the San Joaquin Valley district. Forrest succeeds **H. D. Hobson,** who recently was named supervisor of exploration for California. He served in the Army with the 64th Engineers' topographic battalion and later was attached to General MacArthur's command to collect geologic data for the administration of economic rehabilitation in Japan.

»

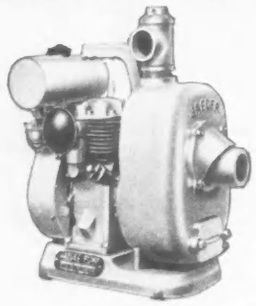
Jack H. Rice has been named division superintendent of The Ohio Oil Company Pipe Line department at Casper, Wyo., succeeding **R. M. Sackett,** resigned because of ill health but who will continue with the company.

»

Robert G. Behrman, Jr., formerly with Gulf Oil Corporation, Houston, has joined **Cecil Hagen,** oil producer, Gulf Building, Houston.

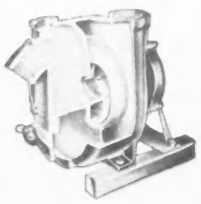
another reason why

JAEGER PUMPS
are the kind you need...



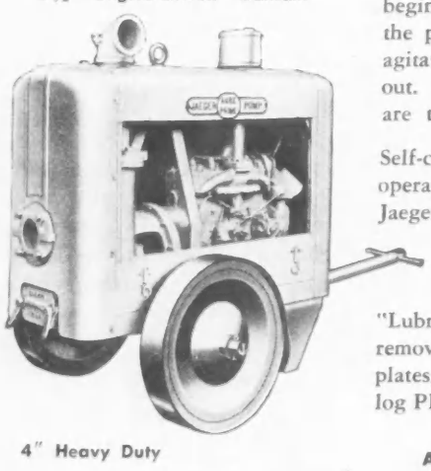
1½" Engine-driven "Bantam"

Self-Cleaning!

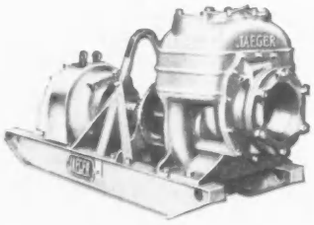


This cutaway shows a big reason why Jaeger Pumps are ideal for oil and gas field service. Those clean, clear passages mean no pockets or corners to hold sediment and cut efficiency. Note how discharge begins at the very bottom of the pump shell, to violently agitate sediment and carry it out. And, impeller blades are trash-type — won't clog.

Self-cleaning means trouble-free, dependable operation — just one of many features of Jaeger Pumps. There's doubly-sure and fast priming action, automatic priming jet cutoff which adds 8 to 12 per cent to performance, patented Jaeger "Lubri-Seal" that seals shafts positively, and removable, replaceable hardened-steel liner plates, plus other Jaeger "exclusives." Catalog PF8 tells all about them . . . Write for it!



4" Heavy Duty



Electric-Motor-Driven on Skid Base

APPLICATIONS
Drill Rig Water Supply • Tank Transfer
Jetting • Dewatering Pipe Lines
Mud Transfer • Pumping Tank Bottoms
General Dewatering

SIZES
1½ to 10 inches • 3,000 to 240,000 gph

TYPES
Engine and Motor-Driven
Lightweight • Heavy Duty • Jetting
High Pressure • Lift & Force Diaphragm

THE JAEGER MACHINE CO.
FACTORY — Columbus 16, Ohio

REGIONAL OFFICES: 1504 Widener Building, Philadelphia 7, Pa.
226 N. La Salle St., Chicago 1, Ill., 235 American Life Building, Birmingham 1, Ala.
Distributors in 130 Cities in the U. S. and Canada.

NOW

A Direct Route to

VENEZUELA - JAMAICA - CUBA

from

NEW ORLEANS and HOUSTON

The C & S "CARIBBEAN COMET" provides direct, one-carrier service to Venezuela and South America from the oil and industrial area of the Southwest. One-plane service to Caracas and Kingston. Non-stop service from Houston to Havana. Three flights weekly from both Houston and New Orleans by fast, four-motored Dixieliners. Departures every Tuesday, Thursday, and Saturday afternoon.

"12 YEARS OF PERFECT SAFETY"

Ask your travel agent, or

CHICAGO & SOUTHERN AIR LINES

General Office, Memphis, Tennessee, U.S.A.

C★S

THOMPSON-HAYWARD FORMALDEHYDE *Reduces* CORROSION

- **Save on Pulling Costs**
- **Save on New Steel**
- **Save on Shutdown Time**
- **Low Cost**
- **Dependable**
- **Field Tested**

Protect expensive and hard-to-get steel parts from hydrogen sulphide corrosion and corrosive mine and well waters, with Thompson-Hayward Formaldehyde.

Warehouse Stocks Available For Prompt Shipment

THOMPSON-HAYWARD CHEMICAL CO.

DALLAS WICHITA HOUSTON TULSA NEW ORLEANS DENVER SAN ANTONIO

"I'll take the WHITE one every time!"

WYTEFACE "A"
Trade Mark
Steel Tapes for the Oil Industry

WYTEFACE "A" Steel Tapes have raised black graduations on a crack-proof white surface. Easy to read in any light, from any angle. Designed for hard service. Resist rust and corrosion. Raised rims and markings protect the white background from abrasion from rails, pipe, rocks, concrete. Made in styles especially for Oil Riggers, Oil Gaugers and for general measurements. See your supply house, or write for details to Keuffel & Esser Co., Hoboken, New Jersey.

KEUFFEL & ESSER CO.
EST. 1867
NEW YORK • HOBOKEN, N. J.
Chicago • Detroit • Los Angeles
St. Louis • San Francisco • Montreal

John E. Boulder was elected to the board of directors and appointed vice president in charge of the Simrall division of the Roosevelt Oil and Refining Corporation, Mt. Pleasant, Mich. Boulder formerly was with Sun Oil Company, Roosevelt Oil and Refinery Corporation recently purchased all the outstanding capital stock of the Roosevelt Oil Company, Simrall Corporation and C. L. Maguire, Inc., and the three companies have been combined with the parent company.

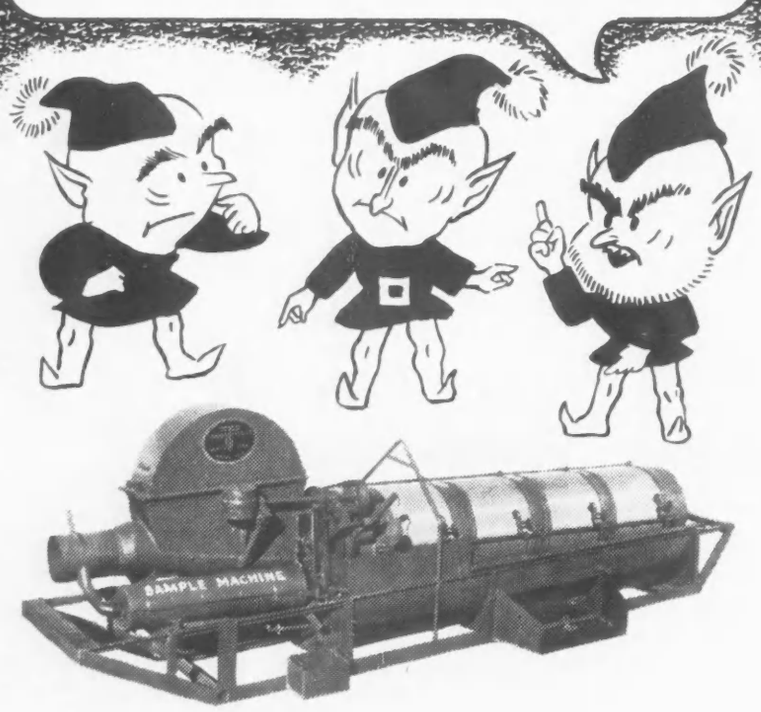
Harold S. Edwards has been appointed district geologist for Stanolind Oil and Gas Company at Wichita Falls, Texas, succeeding **S. P. Ellison, Jr.**, who has resigned to join the University of Texas.

»

James Roy Maxey joined Deep Rock Oil Corporation, Tulsa, as superintendent of geophysics. His experience includes employment with Humble Oil and Refining Company, The Carter Oil Company, the Sohio Petroleum Company, the United Geophysical Company, and the Wichita Exploration Company.

"KILLER" SHALE SAYS:

AND STAY AWAY FROM ANY WELL WITH A THOMPSON SHALE SEPARATOR! YOU WON'T HAVE A CHANCE!



Shale and abrasives don't have a chance to chew up expensive drilling equipment when drilling mud is conditioned with a Thompson Shale Separator... *only clean mud* goes back into the well. If you are drilling deep, you'll want the Thompson "DWF," capable of handling maximum flow from the biggest mud pumps now in operation. Two other models available for shallow and medium depth wells. Attached SAMPLE MACHINE provides accurate foot-by-foot samples of cuttings

For complete data and specifications on all Thompson models, write today for free illustrated folder.

THOMPSON TOOL CO.
IOWA PARK, TEXAS

KEEPS DRILLING MUD CLEAN — PROVIDES *TRUE* SAMPLES OF CUTTINGS

John R. Parker was named district landman at Midland, Texas, for Phillips Petroleum Company. An independent operator in Indiana and Mississippi for the past two years, Parker will be in charge of land and lease operations for Phillips in the West Texas district. **R. I. Sewell,** assistant District Landman at Midland, will continue in his present position. No changes in the district geological office will be made.

John R. Parker

»

Ralph F. Acker has been appointed assistant manager of the Land department of General Petroleum Corporation, which has established district offices at Bakersfield, Ventura, San Francisco and Los Angeles, according to **B. A. Otis,** acting manager. Assisting Acker is **H. B. Lathrop.** They will headquarter at Los Angeles. The four district offices will be headed by **W. Paul Carver,** Bakersfield, for the South Joaquin area; **Charles F. Sawyer,** Ventura, for the Coastal district; **Frank J. Gaspar**, San Francisco, for the Sacramento and North Joaquin area; **Parke W. Jackson,** Los Angeles, for the southern area of the state. Acker, a veteran of more than 20 years with General Petroleum, has been land agent for the company in Los Angeles since 1943. Lathrop has been with General Petroleum since 1932.

»

W. C. Taylor, Southern Division Material and Traffic Manager for Interstate Oil Pipe Line Company, was honored at a dinner in Shreveport at which time **Loren F. Kahle,** president of Interstate, presented him with a 40-year service pin. Taylor's career with the Standard group began in 1908, when he was employed by The Ohio Oil Company at Marshall, Ill. Since that time he has served as purchasing agent of Standard Oil Company of Louisiana, purchasing agent for Standard Pipe Line Company, superintendent of material and traffic for the Pipe Line department of the Standard Oil Company of Louisiana, and after the properties were acquired by Interstate Oil Pipe Line Company in December, 1944, assumed his present position.

»

Joe E. Keyser, formerly geologist for The Ohio Oil Company at Wichita Falls, Texas, has resigned to take charge of new district offices of Woodley Petroleum Company opened at Midland, Texas.

»

F. C. Whiteside, formerly division engineed of the Northern division, Interstate Oil Pipe Line Company, has been promoted to assistant chief engineer and his successor is **Sam Phelps,** formerly engineer in the Northern Division Engineering department. Both will remain at Tulsa headquarters.

BOWEN
AUTOMATIC LINE WIPER No. 8000

Bore of Body	2¾"
Connection	3"
For Line sizes	3/16 to ⅞"

for

SWABBING - BAILING
WIRE LINE CORING

*Wipes the line clean
*Keeps the floor clean
*Eliminates Fire Hazard
*Conserves Oil, Gas, or Drilling Fluid
Sturdily Constructed
Self Adjusting
Entirely Automatic
Trouble Free

Other models including Casing Sizes and Special Purpose Types are available and in stock.

Complete details will be mailed on request

THROUGH YOUR SUPPLY STORE ANYWHERE

BOWEN CO. of TEXAS, INC.

Office: 2429 Crockett St., P. O. Box 1025, HOUSTON 1, TEXAS, Phone Atwood 8-4568—Odessa, Texas, Phone 789—Midland, Texas, Phone 1439. Houma, La., Phone 6709—Oklahoma City, Phone 6-8087

KILL WEEDS NOW
...the easy chemical way with TRIOX®

Now is the time to use TRIOX . . . before weeds flourish after the fall rains. TRIOX will kill 'em before they get started so you'll have no dead weeds to clean off later. TRIOX is a potent chemical weed killer . . . and it's a cinch to apply. It will sterilize the soil against weed growth and prevent plant growth from 2 to 3 years. TRIOX treated weeds will not burn! Use TRIOX around buildings, tanks, on driveways, walks, yards, parking areas—in fact, any place where weeds are a problem. TRIOX comes in 5, 30 and 50 gallon drums—better order some today and clean up those weeds. Phone the nearest office below for information and prices.

ORTHO
SCIENTIFIC PEST CONTROL

CALIFORNIA SPRAY-CHEMICAL CORP.

Richmond, Calif. (phone 3366) • Whittier, Calif. (phone 436-31) • Oklahoma City (phone 7-6468) • Kansas City, Mo. (phone Grand 5126)

This Trouble-Free PIPE WRENCH Saves You Money

RIDGID Wrenches offer you exclusive advantages that save time, work and cash

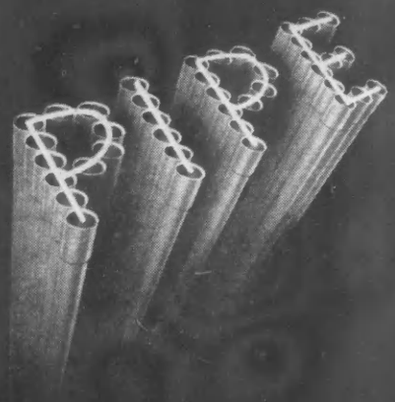
● The important work-saver features which have made RIDGID the outstanding choice of pipe experts all over the world mean fast easy work and real economy for you. Housing is guaranteed against breakage or distortion—no repair expense or bother, ever. Adjusting nut in open housing spins easily in all sizes, 6" to 60." Handy pipe scale on hookjaw. Instant-action non-slip, non-lock jaws. Powerful comfort-grip I-beam handle. RIDGIDs save you time and money. Buy them at your Supply House.

UNCONDITIONAL GUARANTEE
If this Housing ever Breaks or Distorts we will replace it Free
THE RIDGE TOOL CO.
TRADE RIDGID MARK

RIDGID Strap Wrench won't mar polished pipe or tubing.

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY • ELYRIA, OHIO

FOSTER'S



A COMPLETE WAREHOUSE SERVICE SINCE 1902

RAIL
TRACK ACCESSORIES
PILING • PIPE
WIRE ROPE

SINCE 1902

L. B. FOSTER COMPANY

PITTSBURGH 30 NEW YORK 7
CHICAGO 4 HOUSTON 2
SAN FRANCISCO 4

Five convenient warehouses for prompt delivery

WRITE FOR FOLDER No. F-107

MEN IN THE INDUSTRY NEWS

Ray H. Anders was named as director of purchases for Sun Oil Company, succeeding **Henry Thomas**, who retired December 1 after 36 years of service. Anders, until recently manager of Sun's Industrial products department, will be assisted in his new duties by **Roy A. Hurst**, assistant director of purchases. Thomas had been Sun's director of purchases since January 15, 1937. Prior to that appointment he had an interesting 25-year career as an engineer in several divisions of the company. Anders became associated with Sun in 1929 as an industrial products salesman in the Trenton (N. J.) district. In 1944 he was named assistant manager of the Industrial Products department and in 1946 succeeded **Frank R. Markley**, now Sun's general sales manager, as manager of the department.

Ray H. Anders

Robert E. L. (Bob) Rowland has retired as aide to **M. C. Scott**, assistant general manager of operations, Stanolind Pipe Line Company, Tulsa. Rowland went to Tulsa in 1916 as assistant to **J. R. Manion**, general manager of the old Sinclair-Cudahy Pipe Line Company which later became the Sinclair Pipe Line Company and in 1933 was taken over by Stanolind Pipe Line Company.

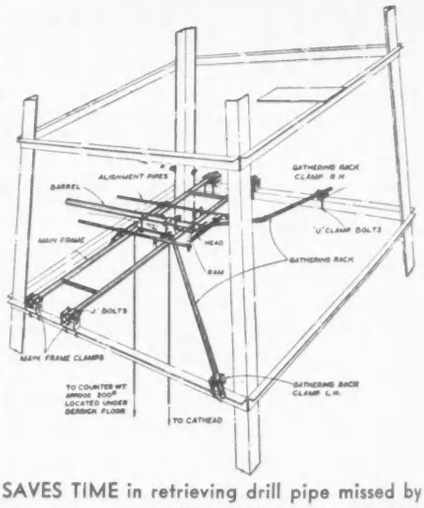
Sydney Belither, who has been in charge of Pacific Coast operations for Shell Oil Company, Inc., since 1934, will retire December 31. **P. E. Lakin** will move from New York to replace him. Since 1942 Lakin has been in the head office of Shell in New York as vice president in charge of marketing east of the Rockies.

Herbert C. O. Clarke, Illinois Producing division manager, has retired and is succeeded by **Mark H. Plummer**, who has been assistant to the division manager of The Pure Oil Company's Gulf Coast Producing division at Houston. During his 23 years in the Producing division, Clarke held assignments in Venezuela, and was manager of the Pacific Coast Producing division. Plummer joined Pure in 1923 as lease purchaser. He later became a land agent and served in the Land department until his appointment to the division management staff at Houston.

George W. Schneider has been promoted from division geologist to assistant to the division manager, The Texas Oil Company, Louisiana division, Producing department, New Orleans, and has been succeeded by **Harry X. Bay**, promoted from senior geologist.

Grime does not pay
It's Waterless
Oil Base
HAND CLEANER
Easy on greasy hands
All you do is rub a dab of Oil Base Hand Cleaner on your hands, like ordinary soap, until grime dissolves—then wipe off on rag or paper towel. Needs no water. Cuts grease, oil, tar, creosote, paint, printers' ink, Black Magic oil base drilling fluid. Soothes cuts, scratches and chapped skin. On sale at supply stores. Write for free sample.
Packed in 1 lb. and 5 lb. cans
OIL BASE, Inc.
130 ORIS STREET
COMPTON, CALIFORNIA

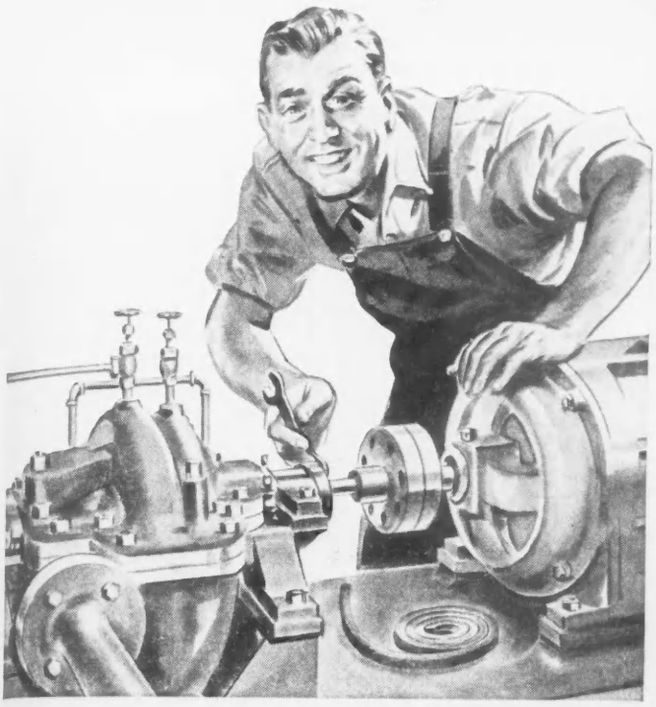
MECHANICAL DERRICK MULE



SAVES TIME in retrieving drill pipe missed by derrickman • SAVES LABOR while handling drill collars • PROMOTES SAFETY—Derrickman never has to leave monkey board to help recover pipe hung up behind brace or girt.

See Page 2643 Composite Catalog
Patent #2,418,728

MECHANICAL MANUFACTURING CO., INC.
BOX 1001 PHONE 4-3261
FORT WORTH, TEXAS
EXPORT: BROWN & BECKLEY
30 Rockefeller Plaza, New York



NOW THIS PUMP IS PACKED
—and Packed Right!

When you pack your centrifugal or rotary pumps with Garlock packing you can be satisfied that they are packed with the highest grade materials. Some of the most widely used Garlock braided asbestos packings for rotating shafts are:

FOR WATER

GARLOCK 730 or 733 patented Lattice-Braid
GARLOCK 234 Square braid
GARLOCK 244 Square braid—wire inserted yarn
GARLOCK 644 Square braid—with lead strands

FOR OIL OR GASOLINE

GARLOCK 237 Square braid
GARLOCK 732 patented Lattice-Braid—with wire

FOR MINERAL ACIDS

GARLOCK 736 patented Lattice-Braid—blue asbestos
GARLOCK 230 Square braid—blue asbestos

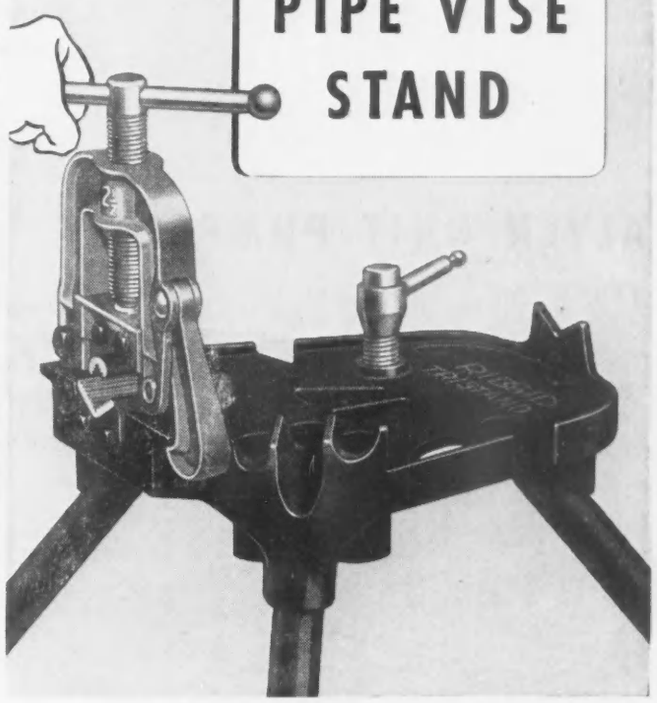
No matter what you require in the way of a pump packing, Garlock makes it. Let the Garlock representative survey your pumps and make recommendations.

THE GARLOCK PACKING COMPANY
PALMYRA, N. Y.
Tulsa, Okla. Houston, Tex.
Los Angeles, Calif.

GARLOCK

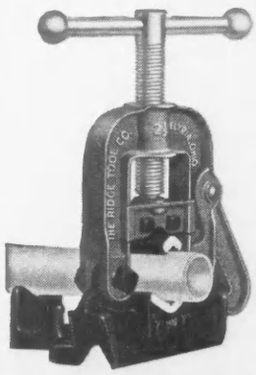
EASIER WORK

with this handy
PIPE VISE
STAND



RIDGID Tristand
is also a portable work bench

● Thousands of pipe experts use the tip-proof RIDGID Tristand both as a pipe vise *and* an on-the-job work bench. Hinged legs fold in and chain for easy carrying. Roomy tray for oil can, dope pot; special slots for hanging tools. Pipe rest and three handy benders that won't dent pipe. LonGrip tool steel vise jaws hold pipe firmly, won't mar polished pipe. The Tristand is made also with chain vise, capacity 4." Buy these handy efficient vises at your Supply House.



●

RIDGID *Pipe Vises include bench, post, stand and kit models—yoke and chain.*

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY • ELYRIA, OHIO

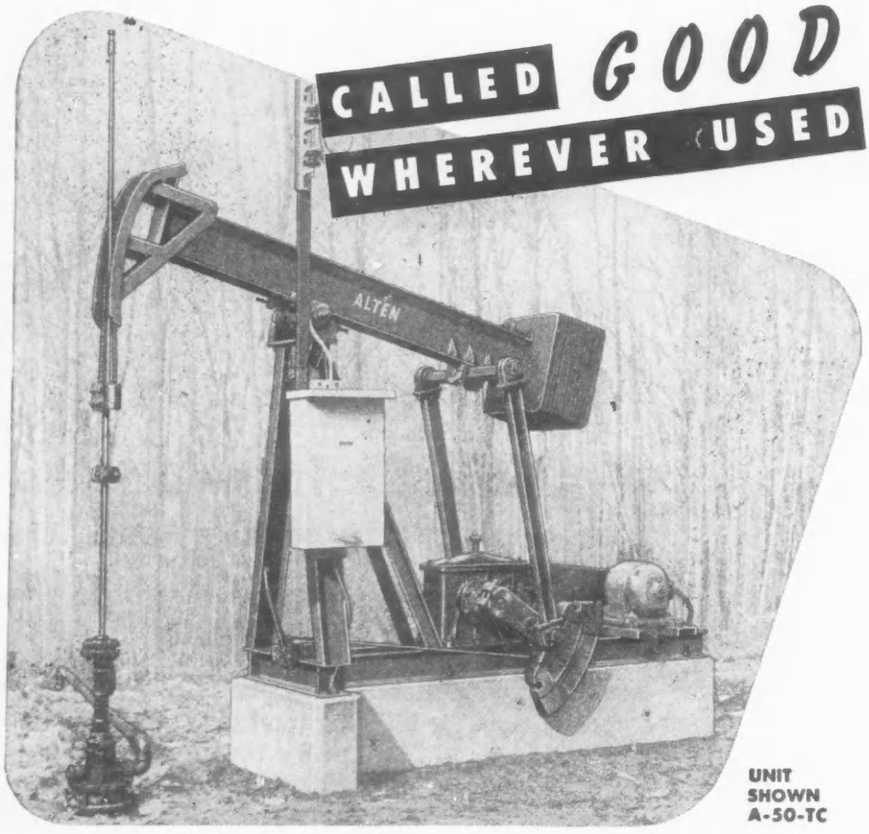
Victor G. Hill, formerly Stanolind Oil and Gas Company division geologist at Oklahoma City, has been promoted to central division exploration superintendent. **George H. Galloway** succeeds him as division geologist. **H. H. Kister,** has been transferred from Oklahoma City to Tulsa on special geological assignment. **Thomas A. Hendricks** has been named top geological advisor in the Foreign department.

George S. Engle, Evansville operator who has opened several new pools this year, has purchased two rigs from the Pioneer Drilling Company and has organized Flamingo Oil Company and the Flamingo Drilling Company.

»

Grover E. Murray has resigned from the geological staff of Magnolia Petroleum Company to accept a professorship at Louisiana State University.

ALTEN UNIT PUMPERS



UNIT SHOWN A-50-TC

Quality Features Include:

★ High-Capacity Double-Reduction Gear Reducer. Chrome-Nickel Steel Pinions. Hardened Steel Gears. Helical Shaved Gearing. Roller Bearing Equipped Throughout.

★ Double-Row, Spherical Self-Aligning Wrist Pin and Equalizer Roller Bearings.

★ Rigid, All-Welded, Structural Steel Samson Post and Frame.

★ Adjustable Stroke Lengths, Effective Balancing, For Use With Gas Engine or Electric Motor.

★ High Efficiency. Weatherproof Construction.

SEND FOR NEW CATALOG

Complete Pumping Unit Specifications Also illustrates Alten Casing Heads, Stuffing Boxes, Stop Cocks and hundreds of other production items

ALTENS
FOUNDRY AND MACHINE WORKS, INC.
LANCASTER, OHIO
Established 1889
Sold Through Dealers Everywhere

Allison J. McNay was named supervisor of a new education division in the Public Relations department of Standard Oil Company of California. He has been assistant supervisor of audio-visual aids in the Los Angeles School Department. In his new position, McNay will direct the development of petroleum education material for students and teachers from primary to college levels. He also will work with schools in classroom use of the Standard School Broadcast and Standard's motion picture.

Allison J. McNay

»

George W. Schneider, division geologist for The Texas Company, has been advanced to assistant to the Louisiana division manager. **Harry X. Bay,** senior geologist, has been elevated to division geologist to suceed Schneider. Schneider entered the employ of the company at Shreveport in the old Louisiana-Arkansas division. In February 1929, he was moved up to division geologist. Bay started with Texaco as a geologist at Mt. Pleasant, Texas, in 1936. After working at Sulphur Springs and Shreveport, he was transferred to the Houston office in 1941. He was moved to the Louisiana division offices in New Orleans in 1943, and in 1945 was named senior geologist.

»

Ford Turner, Saginaw, Mich., has resigned as land agent for The Pure Oil Company after 29 years of continuous service.

»

L. A. Coon has resigned as district geologist for Devonian Oil Company at Jackson, Miss., to accept a position with The Texas Company in New Orleans, La.

»

David D. Dellinger, treasurer and vice president in charge of finance for Continental Supply Company, Dallas, has resigned to become vice president in charge of finance for Fred M. Manning, Inc., oil well drilling contractors, Denver, with offices in the Continental Oil Building. Dellinger joined Continental in 1933 and shortly afterwards was made assistant treasurer. He was elevated to treasurer in 1940, and to vice president in charge of finance for Continental early this year.

»

R. L. Clifton, chief geologist for Champlin Refining Company at Enid, Okla., has resigned and is now engaged in consulting work at Enid.

»

J. F. Hendrickson has been promoted to assistant chief engineer of the production department of Phillips Petroleum Company and has been transferred from Ponca City to the Bartlesville, Okla., headquarters.

The LEADER... for 25 years!

MILLER SAND PUMPS

And Regular Bailers

- **Thousands of MILLERS in use Throughout the World!**
- **The Standard Clean-out Tool!**

O. D. Sizes on MILLER SAND PUMPS are: 2½, 3, 3½, 4¼, 5, 5½ and 7 inches. Lengths are 20, 25 and 30 feet. The bail is welded to heavy seamless steel tube. Long heavy grooved plunger assures a liquid seal. Has three interchangeable bottoms. Wire line is direct connected to plunger—gives greater suction. DOES THE JOB! FAST! ECONOMICAL!

MILLER REGULAR BAILERS are made in 2½, 3, 3½, 4¼, 5, 5½ and 7 inch O.D. sizes and in 20, 25 or 30 foot lengths. Sectional Bailers made to your specifications. See Composite Catalog, page 2666, for prices, parts and details.

MILLER SAND PUMP CO.

1524 SE 29th Street
BOX 4516, OKLAHOMA CITY, OKLAHOMA
Export Office
30 Rockefeller Plaza, New York 20, N. Y.

Preferred for Gas-Engine Fuel Service

Universal Gas Regulators

Now . . . a stamped-steel service regulator! Stronger, lighter and tighter than cast iron.

New features insure better regulation, lower first cost, low upkeep, long life, satisfaction.

This is a *dry* regulator. Vertical diaphragm means positive drainage of moisture. Cannot fail in freezing weather. Flanges protect entire diaphragm from sun and weather damage.

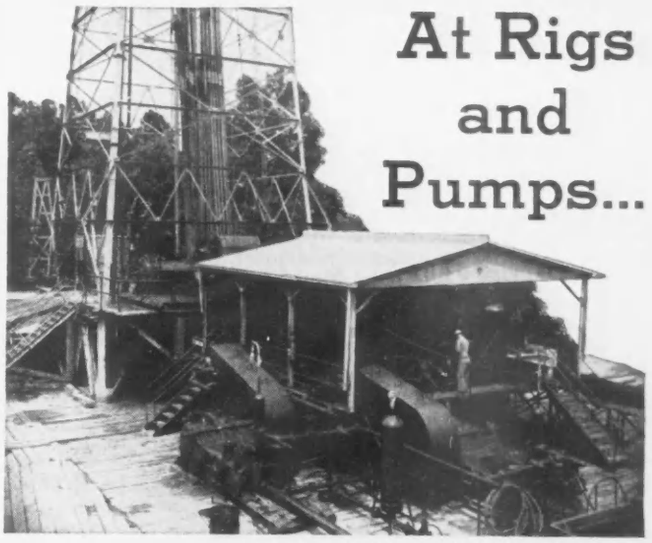
Cadmium plated. Aluminum painted. Union joint permits 4-way positioning for any pipe run.

Ideal for gas engines and for reducing gas pressure to field type heaters and treaters.

Investigate. See your supply company. Or write for Catalog 101.

MADE IN THE HEART OF NATURAL GAS AREA!

Universal Controls Corp.
731 WEST DAVIS STREET — DALLAS 8, TEXAS



At Rigs and Pumps...

PHOTO COURTESY STANDARD OIL CO. (N.J.)

...men say "WICO" instead of "Magneto"

And well they may, for the reputation of WICO magnetos has led all the rest for two score years wherever oil comes in. Oil men know that in sand or swamp, however rough the conditions, WICO magnetos deliver the hot, strong, reliable spark that's the heartbeat of the engine.

WICO magnetos stood the test of years of use on all kinds of internal combustion, spark-ignited engines in oil fields all over the world. Every new WICO model is tested for days in a "dust bowl" at the laboratory where extra fine, highly abrasive sand sweeps around the operating magneto. In a nearby humidity box, with 100° temperature and 95% humidity, each WICO model runs continuously day after day — for thousands of hours — while moisture drops on and from it.

No wonder men at the rigs and pumps say "WICO" instead of "magneto". That way they *know* they'll get topflight magneto performance.

Trained field engineers and more than two thousand authorized service stations serve WICO users everywhere. Wico Electric Company, West Springfield, Massachusetts.

SINCE 1897
WICO
DEPENDABLE IGNITION

Thomas H. Green, formerly geologist for Shell Oil Company, Inc., in the Oklahoma area, has joined Sunray Oil Corporation as district geologist in Oklahoma City. **A. M. Wright** has been named district landman at the Oklahoma City office and with Green will coordinate exploration activity in southern and western Oklahoma. **Maurice H. Smith** has been named assistant district geologist there.

»

Sam H. Casey has been appointed manager of the crude oil purchasing department of Root Petroleum Company. He will have headquarters in Shreveport.

»

E. G. Robinson has been elected to membership on the advisory council of the Department of Geological Engineering of Princeton University. Robinson is manager for Shell Oil Company's New Orleans area with offices in the Richards Building, New Orleans.

»

F. Raymond Wheeler, petroleum engineer in charge of reservoir analysis equipment for Engineering Laboratories, Inc., Tulsa, has resigned to become affiliated with the Chemical and Geological Laboratories at Casper, Wyo., where he will organize and head a petroleum engineering department for the firm.

»

Earl Moore, drilling superintendent of the Oklahoma division, Bishop Oil Company, has been appointed superintendent in charge of all drilling operations for the company with headquarters at Ada, Okla. **Carl Todd,** division geologist for the company, has been named chief geologist with headquarters at Wichita, Kansas.

L. B. Snedden has been promoted to assistant manager of the Geophysical division, Producing department, The Texas Company. Snedden, who will have headquarters in Houston, has been stationed at Bakersfield, Calif., where he was district geologist and supervisor of geophysical operations in California.

»

K. A. Schmidt, district geologist at Jackson, Miss., for Tide Water Associated Oil Company, has been promoted and transferred to the Houston office, succeeding **F. Hugh Wilson.**

»

Dr. John H. Maxson, formerly with Bay Petroleum Company, has been named district manager at Denver, for Anderson-Prichard Oil Corporation of Oklahoma City. The newly opened district will supervise all activities in the Colorado-Wyoming area of the Rocky Mountain district.

»

W. L. Dutton, head of the engineering department of Union Gas Company of Canada, Ltd., will have supervision of all operating departments through the Union system in southwestern Ontario. His responsibilities as operations manager will include the supply of natural and artificial gas, compressor stations, transmission lines, and distribution.

»

Rube Mills has been named district geologist for Stanolind Oil & Gas Company at Midland, Texas. He will work in the West Texas Exploration department which is headed by **Gail Stoddard.** Mills was formerly at the Corpus Christi district office.

Gotkool
WATER CANS
& COOLERS
GOTT Water Coolers are the convenient way to keep drinking water handy to the worker, protect it from impurities. Their exclusive construction keeps water cool for long periods. Snug fitting large removable top, handy non-leaking push button faucet. GOTT Water Cans for handy field use. Your Supply Store has them, get one today! . . . .
GOTKOOL WATER COOLER
Made in 2, 3, 5, 8, 10, 15 and 20 gallon sizes with Push-Button Faucet.
GOTKOOL WATER CAN
Made in 1½, 2, 3, 5, 10, 15 and 20 gallon sizes. (Push-Button Faucet at slight additional cost.
H. P. GOTT MFG. CO.
WINFIELD, KANSAS
KEEP PURE DRINKING WATER ALWAYS HANDY

Transfers

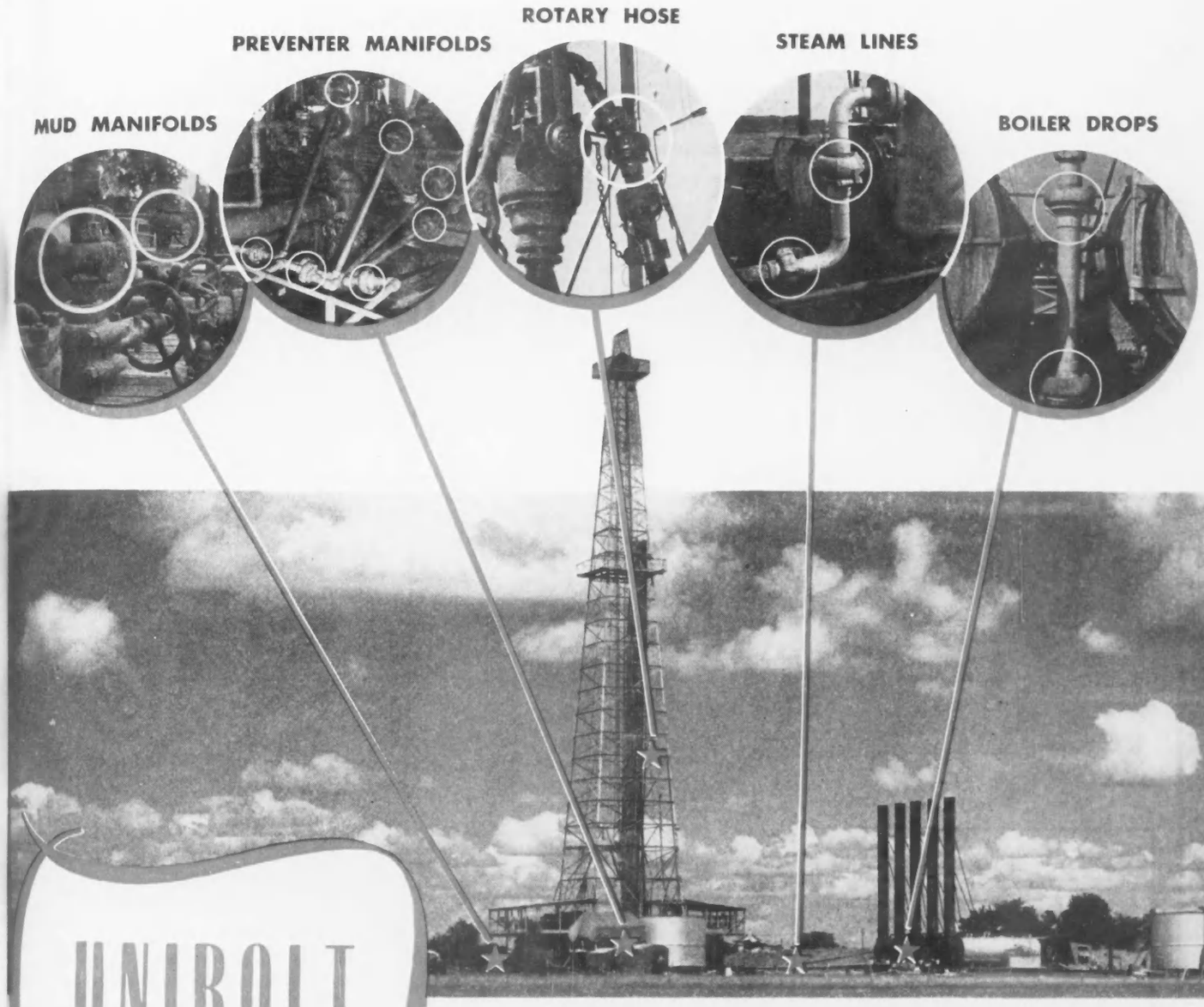
Humble Oil & Refining Company announced the following promotions and transfers of supervisory personnel in the Production department: A district superintendent, district civil and petroleum engineers, and a district chief clerk have been named for Humble's new California district office in Los Angeles. They are **J. H. Galloway,** former superintendent of the Means district in West Texas; **M. O. Pattison,** who was civil engineer in the Hobbs district, West Texas division; **C. W. Armstrong,** former senior petroleum engineer in the Houston office; and **J. A. Porter,** senior clerical supervisor in the production operating department, Houston. **V. L. Garlington** has replaced **F. S. Godbold** as district civil engineer in charge of construction of additions to the Conroe Gasoline Plant. Godbold was transferred to the Opelousas Gas Plant Construction district to supervise construction of the new Opelousas plant. **B. J. Smith,** senior petroleum engineer, has been transferred from the Louisiana division office to the Mallalieu, Miss., district. **S. T. Collins,** district civil engineer, has been transferred from Paradis district to Hub district, Louisiana division. **A. B. Simons,** civil engineer in the Gulf Coast division, was transferred to the Civil Engineering department in Houston with the same title. Three Humble tool pushers have been transferred. They are **L. E. Taylor,** from Tomball district to Conroe district; **F. B. Meyer,** from Livingston district to Hardin district; and **L. E. Cezeaux,** from Bayou des Glaise district to Grand Isle district, Louisiana division. **C. J. Ott,** electrician first, Friendswood district, was promoted to district electrical foreman in the Freeport district.

»

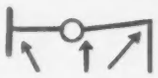
W. W. Phillips, former assistant district superintendent at London, Texas, has been named district superintendent at Gladewater, Texas, for Humble Oil and Refining Company. **A. J. Bedford,** assistant division chief clerk of the Southwest Texas division, has been promoted to division chief clerk of the West Texas division, and **H. J. McDonald,** district chief clerk at Government Wells, was promoted to Bedford's former position. **B. A. True,** assistant district chief clerk at Kelsey, has been promoted to district chief clerk at the Kelsey Gas Plant Construction district. New district chief clerk for the Seeligson Gas Plant Construction district is **M. A. Banner,** former district clerk at Stratton, Texas. **E. J. Stanley,** roustabout, London District, has been promoted to the Gulf Coast division office in Houston as junior civil engineer. **Norman Newsome,** associate petroleum engineer, Petroleum Engineering division, Houston office, has been promoted to petroleum engineer in the Friendswood district.

STRESS-FREE LINES LEAD TO

Economical Rig Maintenance

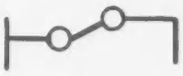


UNIBOLT *Flexi-Ball* JOINTS



STRESS HERE

Using only one Ball Joint does not properly eliminate stress resulting from contraction or expansion.



NO STRESS

Using two Ball Joints in series eliminates stress resulting from contraction or expansion.

The Flexi-Ball Joint, which provides for misalignment up to 38 degrees, depending on the size of the joint, is designed to relieve lines of stress resulting from expansion, vibration, or misalignment. It is a "natural" for flexible manifolds.

The proven UNIBOLT coupling principle is employed to join the component parts of this fitting. As a result, trouble due to galling and freezing of threads is entirely eliminated by the Flexi-Ball design. It is assembled by the simple process of tightening one bolt with an end wrench. Even after extended periods of service, the joint can be quickly dismantled by releasing the bolt.

This fitting may be used safely in any service, since it is made in steel only. Its sizes range from 1½" to 6" and test pressures to 6000 lbs., depending on size; 500 lbs. steam working pressure.

THORNHILL-CRAVER COMPANY

HOUSTON, TEXAS

DEATHS

Mathew R. Rosse, 50, export manager of The Colorado Fuel and Iron Corporation, died October 7 at New York. He was associated with the exportation of steel products and industrial equipment for 25 years.

⌄⌄

Col. Charles R. Taylor, 49, Oklahoma independent oil operator and president of the National Improvement Company, died October 23, at Tulsa from malignant hypertension. A native of Decatur, Texas, he had resided in Tulsa since 1926.

⌄⌄

Eugene T. Scott, 35, former sales manager of Templeton, Kenly & Company, Chicago, died September 30 at Hinsdale, Ill.

Charles F. Meyer, 84, former president of Standard Oil Company of New York, died October 13 at Rancho Santa Fe, Calif. Meyer began his career in the oil business in Boston as an assistant statistician with Standard Oil in 1866. He was made a member of the company's foreign trade committee in 1907 and was elected vice president of Standard Oil Company Of New York in 1920. He became president of the company in 1928 and served in this office until his retirement in 1931.

H. K. Browning, 46, who recently was appointed vice president and general sales manager of Kobe, Inc., died October 26 at his home at Alhambra, Calif., following an attack of coronary thrombosis. Browning entered the oil equipment selling business in 1932. He was made manager of oil country sales for A. M. Byers Company after having been general sales manager for S. M. Jones Company of Toledo, Ohio. He joined Kobe as sales manager at Tulsa in 1948 and later was appointed Mid-Continent division manager with headquarters in Oklahoma City. He was called to the company's head office in Huntington Park, Calif., two years later as general manager.

H. K. Browning

⌄⌄

Otto F. Koch, 82, chairman of the board of Kendall Refining Company, and a prominent figure in the Pennsylvania Grade Crude Oil Association, died October 13, at Bradford, Penn., after a brief illness. He joined the Kendall company in 1906. He was named president in 1918 and became board chairman in 1943.

⌄⌄

Felix R. (Pete) Frederick, 45, senior exploitation engineer on the regional staff for Shell Oil Company, Houston, died October 17, at Port Sulphur, La. Frederick joined Shell in 1930 as a production draftsman in the Houston office. From that time until his assignment in 1946 to the regional staff in Houston, he served in various capacities in Texas and Louisiana as area mud engineer, senior exploitation engineer and district superintendent.

⌄⌄

Albert E. Sager, 52, independent oil man and a Tulsa resident for 30 years, died October 13 following a heart attack. He was a native of Saginaw, Mich., and was awarded the Purple Heart medal for wounds received during World War I.

⌄⌄

J. C. Robinson, 60, production superintendent for J. E. Crosbie, Inc., died November 4 at Tulsa, of a heart attack. Robinson was a native of Canada and went to Tulsa in 1936. He started his oil career as an 18-year-old roustabout for the Crosbie Company in the Glenn pool of Oklahoma and later joined The Texas Company Pipe Line department. In 1925 he became district superintendent of the Crosbie Company in Smackover, Ark., and six years later was transferred to Longview, Texas.

⌄⌄

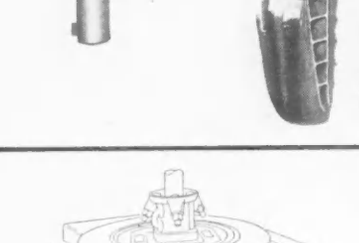
R. G. Rapp, president of Denver Producing and Refining Company, Oklahoma City, was found dead November 1, near the wreckage of a plane which had been missing since October 28. The plane, in which three others lost their lives, crashed near Matador, Texas. Other victims included **L. S. Tunks,** production superintendent for the company; **Mrs. Tunks,** and **Pilot B. B. Parr.** Before joining Denver Producing and Refining Company Rapp was salesman for an oil equipment firm.

DeCo

Balanced POWER SLIPS

8 POINT Superiority

1 INSTALLED DIRECTLY TO ROTARY
2 ALWAYS IN PERFECT ALIGNMENT
3 REMOVABLE SLIP ASSEMBLY FOR "CLEAN-FLOOR" DRILLING OPERATION
4 FLOATING INNER RING SLIP BODY
5 LONG SLIP SEGMENTS
6 EXTRA SAFETY
7 EXCEL IN MECHANICAL SIMPLICITY
8 SLIPS CONTROLLED ENTIRELY BY DRILLER



Rotary table is completely clear during drilling operations. Slip assembly is completely removed . . . pistons are let down . . . floor plates cover piston openings.

DeCo oil field equipment sold through leading supply stores.

6119 East Montgomery Road

THE DeLANEY CO. DeCo DELANEY HOUSTON·9·TEXAS

Steel Fabricating—DeCo Forged Steel Well Head Equipment—DeCo Power Slips—Forgings

Biggest Built... Better Built for Toughest OIL FIELD HAULING

● Here's the largest truck ever built in standard production for oil field service. It's a Mack Model LRSW — 115,000 lbs. gross vehicle weight — powered by a 275 h.p. diesel engine.

Gulf Oil Corporation recently ordered four of these mighty Macks for off-highway operation in the oilfields of Venezuela. Others are being delivered to Asiatic Petroleum Co. and Atlantic Refining Co. for service in the same area. All of these trucks will join numerous other Macks now working in these fields.

In size and stamina, these huge Macks are striking examples of the way Mack designs and builds trucks to meet the specific job demands of punishing oil field work.

For every phase of oil field hauling, there's a Mack truck sized right and built right to do the job as only a Mack can do it — with unmatched economy and enduring reliability. Macks are in there every step of the way . . . hauling scientific exploration equipment, carrying drill rigs, cementing units, draw works, casing, boilers, power units — wherever the job calls for greater capacity, power, strength and flexibility.

IT'S PART OF THE LANGUAGE:

Built like a

Mack

Mack Trucks, Inc. Empire State Building, New York 1, N. Y. Factories at Allentown, Pa.; Plainfield, N. J.; New Brunswick, N. J.; Long Island City, N. Y. Factory branches and dealers in all principal cities for service and parts. In Canada, Mack Trucks of Canada, Ltd.

EQUIPMENT AND SERVICE SUPPLIERS' NOTES

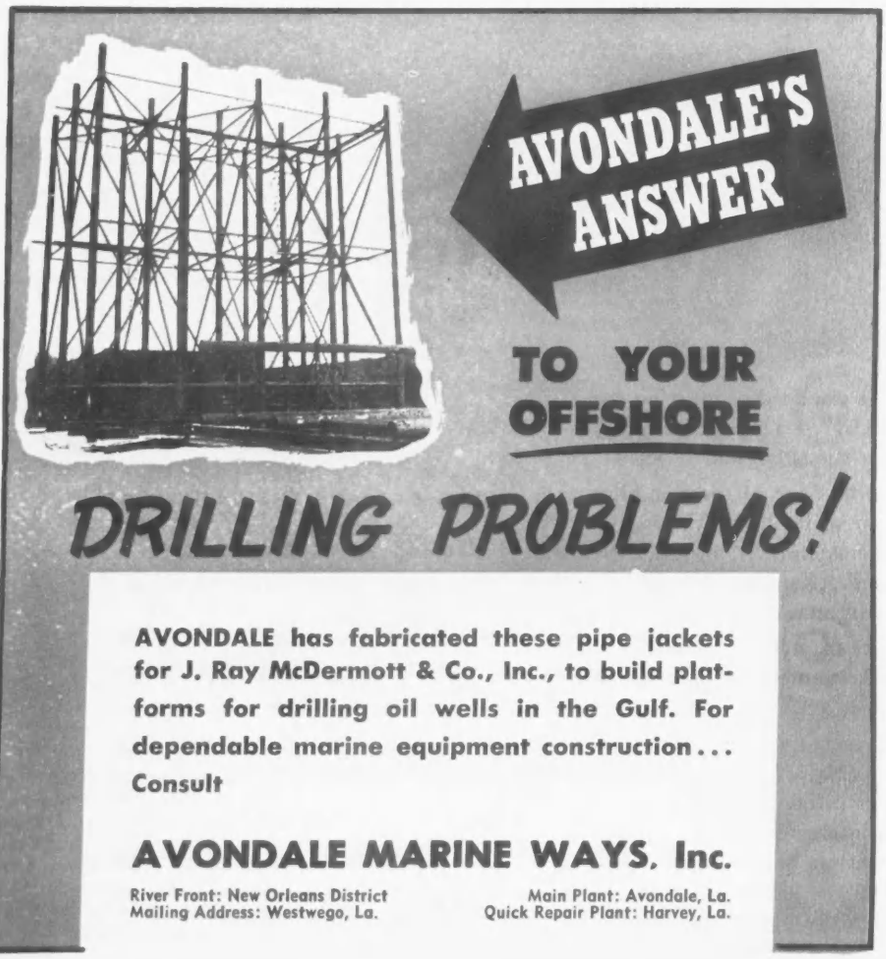
WEATHERFORD HOLDS MEETING—District managers and sales representatives from several states attended The Weatherford Oil Tool Company's general sales meeting in October. Standing, left to right are: J. B. Etter, F. F. Lewis, K. Flanders, M. White, A. Pierce, Cecil Reeves, H. C. Pense, M. F. Wright, N. A. Tinker, H. K. Rockhold, J. B. Brown, J. S. Rabineau, W. S. King, J. C. Stine, R. L. Wood and A. G. Campbell. Seated: H. Rehder, J. T. Rollins, N. R. Rodgers, G. W. Hall, J. E. Hall, Jr., John A. Hall, Lee Martin and Lee Mooty.

John H. Batten Named President Of Twin Disc Clutch Company

Twin Disc Clutch Company announced the election of John H. Batten as president of the company at the annual meeting of the board of directors.

Batten has been associated with the company since 1935, working in various departments and in the general offices. He has been assistant general manager, assistant treasurer, vice president and assistant general manager, and executive vice president. He has been a member of the board of directors since 1937.

P. H. Batten, formerly president and chairman of the board of directors, will continue as chairman of the board.


AVONDALE'S ANSWER
TO YOUR OFFSHORE
DRILLING PROBLEMS!
AVONDALE has fabricated these pipe jackets for J. Ray McDermott & Co., Inc., to build platforms for drilling oil wells in the Gulf. For dependable marine equipment construction... Consult
AVONDALE MARINE WAYS, Inc.
River Front: New Orleans District
Mailing Address: Westwego, La.
Main Plant: Avondale, La.
Quick Repair Plant: Harvey, La.

Two Firms to Serve Producers Are Organized by Lee Flood

Lee Flood of Midland has formed two companion companies to serve the needs of smaller producers of oil and gas in the Permian Basin. One of the concerns, Production Management Company, called PROMCO, is to provide a confidential managerial service to the smaller producer. The other, Production Specialties Company, or PROSCO, will be a medium through which specialized production equipment and services may be obtained. Its aim will be "to provide new techniques and devices that will contribute to more efficient production of oil and gas," according to Flood. Since January 1, 1945, Flood has been chief engineer of the Goldsmith Pool Engineering Committee in Midland, and he will retain that position until December 31. He may continue to serve the committee in an advisory capacity after that time. Headquarters of the new companies will be at Midland. A field office and warehouse will be opened at Odessa.

Lee Flood

Eagle-Picher Elects New President; Bowlby Becomes Chairman of Board

T. Spencer Shore, 45-year-old industrialist and investment banker, was elected president of The Eagle-Picher Company October 22. He will assume office January 1.

Joel M. Bowlby, who has been president since 1941, became chairman of the board and will continue as chief executive officer and general manager of operations of the Eagle-Picher group.

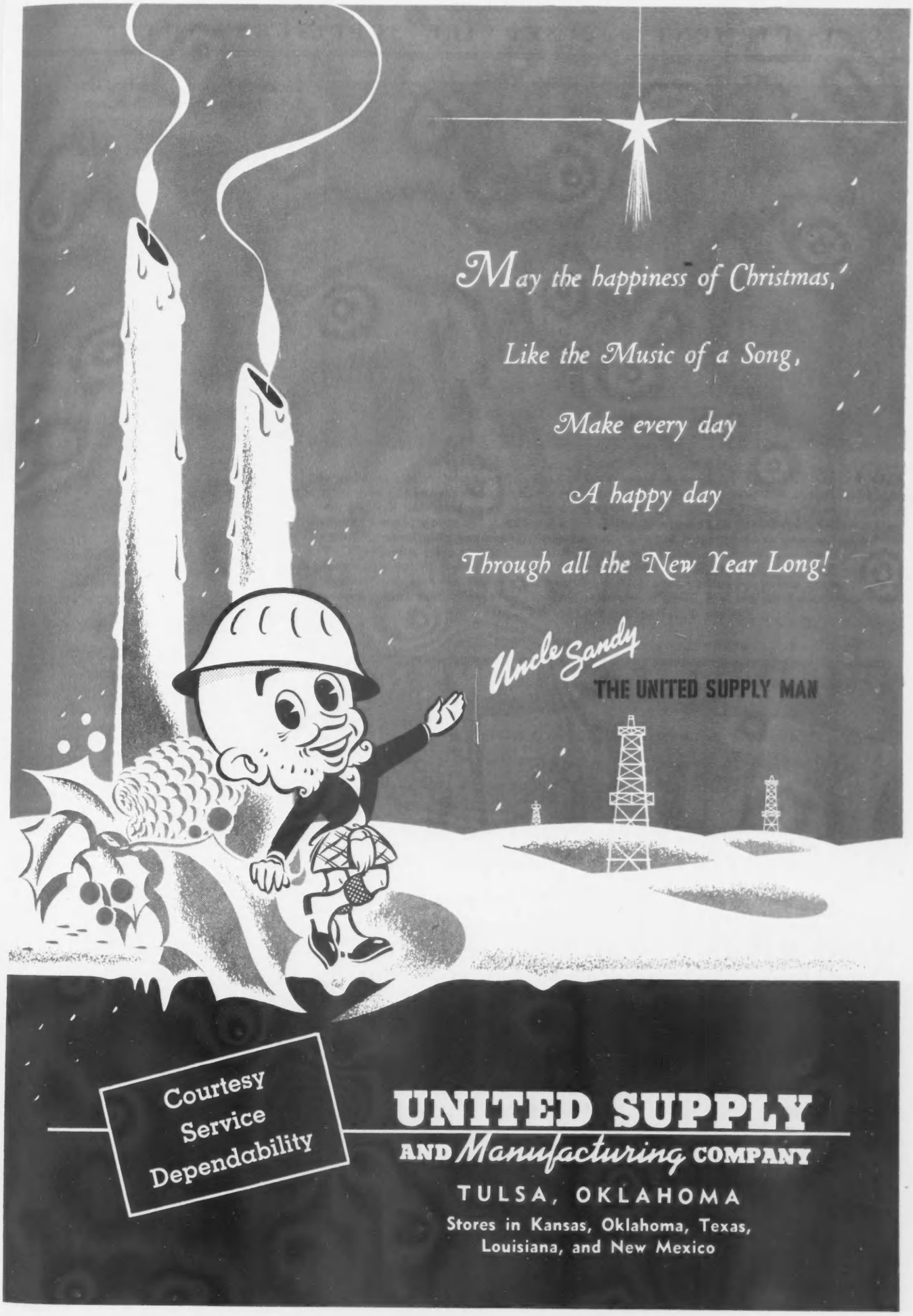
Joseph Hummel, Jr., who has been associated with Eagle-Picher for 57 years and board chairman since 1941, vacated that office and was appointed honorary chairman.

Elmer Isern, formerly vice president of The Eagle-Picher Mining and Smelting Company, was elected president of that subsidiary. Bowlby assumed chairmanship of the board.

The new president has been a member of the Eagle-Picher board of directors since March, 1943. At that time he was vice president and treasurer of The General Tire and Rubber Company of Akron. He later became a general partner of Goldman, Sachs & Company, New York international banking house.

Cyanamid Official Named

Arthur J. Campbell was appointed division manager of the Industrial Chemicals Division of American Cyanamid Company. Campbell was formerly general sales manager of this division.


May the happiness of Christmas,
Like the Music of a Song,
Make every day
A happy day
Through all the New Year Long!
Uncle Sandy
THE UNITED SUPPLY MAN
Courtesy
Service
Dependability
UNITED SUPPLY
AND Manufacturing COMPANY
TULSA, OKLAHOMA
Stores in Kansas, Oklahoma, Texas,
Louisiana, and New Mexico

ALSO FRIED CHICKEN—Southern belles, Virginia Reels and mint juleps with a backdrop of tables heavily laden with fried chicken, Kentucky ham, shrimp and oysters marked the opening of the Tulsa branch of Tube Turns, Inc., which maintains headquarters at Louisville, Ky. The new branch is at 317 South Detroit and consists of offices and a warehouse. Top officials from Louisville attended the opening which attracted hundreds of engineers, oil men and civic leaders. Visiting officials included Jack W. Green, sales manager; T. H. Pike, assistant sales manager; C. B. McLaughlin, head of engineering, Service Division; John E. Chumley, manager flange department, and W. T. Owens, director of public relations. In the picture, left to right, are Pike, Bill Emrich of Tulsa, Miss Margie Mass and R. S. Tyler, Jr., manager of the Tulsa branch. Other Tulsa personnel include W. J. Hamilton and Mrs. J. E. Coyle.

Beckwith Named Liquefied Gas Sales Manager for Richardson

E. Q. Beckwith has been named manager of liquefied gas sales for Sid Richardson Gasoline Company, Fort Worth, according to Frank Andrews, sales manager.

E. Q. Beckwith

The Richardson company is building a large natural gasoline plant in the Keystone field near Kermit, Texas. The plant is to be in operation by February, 1949, with a daily average production of approximately 100,000 gallons of propane and butane and 100,000 gallons of natural gasoline.

Beckwith had experience in LPG sales, engineering and product procurement work with Phillips Petroleum Company of Bartlesville, Okla., and Beacon Petroleum Company of Tulsa. He resigned as president of the latter company September 15.

During World War II, Beckwith served in the Ordnance Department at Washington and as commanding officer of the Lima Tank Depot, Lima, Ohio. Beckwith's new headquarters are in the Fort Worth Club Building, Fort Worth.

WISCONSIN HEAVY-DUTY Air-Cooled ENGINES

Four of a kind — winning power to spare in this hand! The same winning power you draw when you specify Wisconsin Air-Cooled Engines for your equipment . . . compact, heavy-duty singles in two types ranging from 2 to 9 hp.; twin-cylinder models from 7 to 13 hp., and V-type 4-cylinder engines from 15 to 30 hp.

All models are designed for heavy-duty service — delivering "Most Hp. Hours" of on-the-job service.

All models are extremely compact . . . to fit the machine as well as the job.

All models are built to one standard of top-quality excellence in design, materials and precision construction.

For "Winning Power", specify Wisconsin Air-Cooled Engines. Engineering data gladly supplied.

WISCONSIN MOTOR Corporation
MILWAUKEE 14, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

WRITE TO HARLEY SALES CO.
510 Atlas Building, Tulsa, Oklahoma
M & M Building, Houston, Texas
Oil field distributors for Wisconsin Engines and all types of utility units.

Republic to Distribute Rubber Products Made by Goodyear

Republic Supply Company, Houston, has been named distributor of industrial rubber products for Goodyear Tire & Rubber Company.

Announcement of the new distributorship was made by Don L. Collins, Republic vice president and sales manager, and H. E. Langdon, western sales manager of Goodyear's mechanical goods division, Akron, Ohio.

One of the largest supply houses in the west, the Republic firm maintains seven district offices and operates 48 service stores in the Mid-Continent oil field.

In announcing the contract with Republic, Langdon said "the oil industry is without doubt the largest user of mechanical rubber goods, and we are well pleased to have an aggressive, service-minded company like Republic handle Goodyear's line in the west."

New Gun-Perforating Services Announced by Western Company

John Ed Cooper, sales manager for The Western Company, Midland, Texas, announced new gun-perforating services for the firm.

Western's bullet gun makes use of the "folded-barrel" principle which gives up longer barrel and more powder than the conventional guns in oil fields, according to Cooper.

The gun-perforating department, under the management of John F. Younger, will soon have available the jet or "shaped charge" type of shooting.

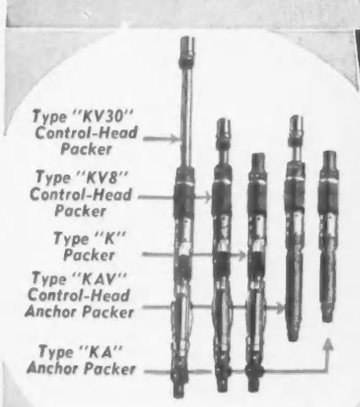
DOUBLE-SEALED

PROTECTION WITH *Guiberson* TYPE "KV" PACKERS

Built for trouble-free performance in deep wells where high pressures and high temperatures are encountered. Guiberson's Type "KV" Packers have double-sealed protection at the valve—the regular tapered metal valve and seat plus a special multi-ring resilient sealing sleeve. The pack-off rubber is oil-resistant, has reinforced ends, and will not vulcanize to the casing. Dovetailed slips are extra large, heat-treated. Heavy seamless mandrel has full opening —internal diameter is same as tubing string. Ample by-pass area permits faster running and pulling in heavy fluid. Valve is locked in open position by rugged gudgeon assembly to prevent closing when running in the hole.

Guiberson "KV" Packers pull with ease. The 30" valve lift on the "KV30" permits a long stroke to dislodge the slips and packing rubber. Type "KV" packers will pull loose easily even with a high head of fluid above the packer, due to the small valve diameter.

Guiberson Type "KV" Packers are ruggedly built of durable materials to give you positive pack-off under the most difficult well conditions. Available in 4¾" to 7⅝" casing sizes. See the Composite Catalog, pages 1508-11, for the complete series of "K" Packers in Hook-wall or Anchor types with or without valve.


Type "KV30" Control-Head Packer
Type "KV8" Control-Head Packer
Type "K" Packer
Type "KAV" Control-Head Anchor Packer
Type "KA" Anchor Packer

SAFER THAN SORRY — GUIBERSON — BETTER BE (REG. U. S. PAT. OFF.)

Guiberson U.S.A.

THE GUIBERSON CORPORATION

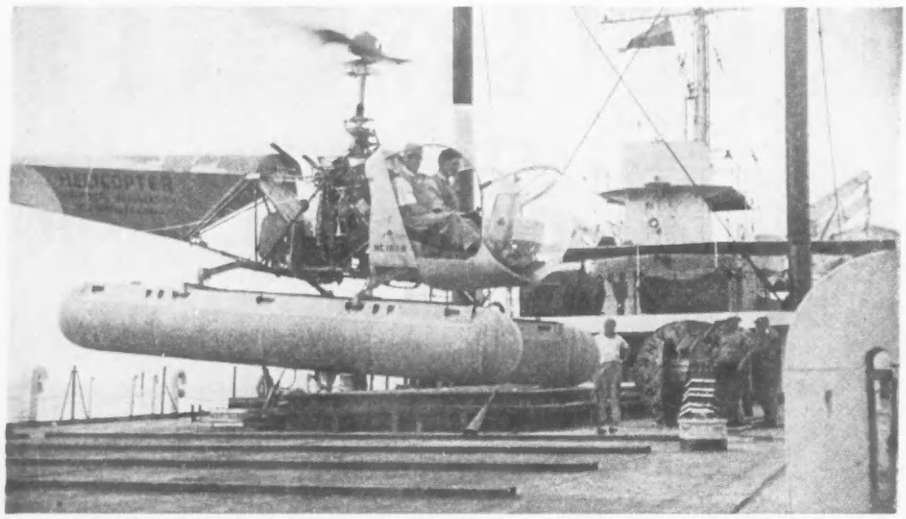
DALLAS, TEXAS — Established 1919

CALIFORNIA DISTRIBUTOR: The W. R. Guiberson Co., 717 East Gage Avenue, Los Angeles 1, Calif.

EXPORT OFFICE: 30 Rockefeller Plaza, New York 20, N. Y.

BRANCH OFFICES IN Oklahoma City, Okla.; Tulsa, Okla.; Longview, Texas; Kilgore, Texas; Alice, Texas; Houston, Texas; Odessa, Texas; Wichita Falls, Texas; Lafayette, La.; Wichita, Kansas; Newark, Ohio.

© 1948, The Guiberson Corp.



HELICOPTER GOES TO SEA—For the first time in the development of offshore oil reserves, a successful helicopter connection was established between land and man-made islands. The Schlumberger Well Surveying Corporation established this service to the oil industry by inaugurating the flight between Grand Isle to Humble Oil & Refining Company's offshore Block 30, State Lease No. 119, Rig 28.

The Bell Helicopter landed perfectly on the deck of the LST Boat, which is itself anchored and connected by a bridge to the drilling platform. R. Henquet, general manager of Schlumberger, was the passenger on the helicopter. The first step opens a new field of possibilities to the oil industry because of a means of communicating very quickly and safely between the man-made islands and shore.

W. F. Slater Heads Hydraulic Equipment Sales for Kobe

W. F. (Pete) Slater, manager of General Technical Service Division, Kobe, Inc., has been appointed manager of hydraulic equipment sales.

W. F. Slater

He joined Kobe in 1940 at Tulsa as district manager and in 1942 was moved to California to become division manager. He has been responsible for the training of Kobe field personnel and direction of field service work since 1945, when he was made manager of the General Technical Service Division.

Hebard Manufacturing Concern Acquired by Buda Company

The Buda Company, Harvey, Ill., has acquired the W. F. Hebard & Company, Chicago, manufacturer of materials handling equipment, including "Shop Mule" tractors and lift trucks. Hebard will be operated as a wholly owned subsidiary of Buda. The manufacturing of its present line of products will be continued at Hebard.

KING TYPES 10-LV AND 10-PD SWIVELS

FOR GEOPHYSICAL RIGS AND SHALLOW WATER WELL RIGS

10-LV Swivel
Patent Pending

Be Sure IT'S A KING *Be Safe*

King Types 10-LV and 10-PD are a departure in construction from most swivels and will impress you with their simplicity.

These swivels have no stuffing boxes, washpipes or packing glands. A moulded rubber seal packs against a hardened wear bushing, making an effective seal that will run many weeks before renewal becomes necessary.

A second seal is placed below the wear bushing, to pack between the bushing and the spindle. This second seal is not subject to wear.

Type 10-LV Swivel has a conventional bail and duplex angular-contact bearings at the top and single angular-contact bearings at the bottom and is for use with small rotary rigs and rigs having a hydraulic feed mechanism.

Type 10-PD Swivel has a combination bail and pull-down yoke, used on rigs equipped with a mechanical pull-down attachment.

The same angular-contact bearings are used in 10-PD as in 10-LV with positions reversed. Duplex angular-contact bearings are at the bottom and single angular-contact bearings at the top.

The bearings in these swivels provide ample thrust and radial capacities to insure long and satisfactory service. They are provided with a means of adjustment below the housing. A grease nipple in a protected opening, provides a means of lubricating the bearings. A good quality of ball bearing grease should be used.

For additional information of King Oil Tools see your Composite Catalog.

All prices F.O.B. Houston, Texas, and subject to change without notice.

Sold through your supply store

Export: **R. S. STOVKIS & SONS, Inc., 17 Battery Place, New York 4, N. Y.**

10-PD Swivel
Patent Pending

KING OIL TOOLS

210 TERMINAL STREET **PHONE W. 6-8013**

HOUSTON 10, TEXAS

ANNOUNCING

A Complete Factory Stock in

HOUSTON, TEXAS

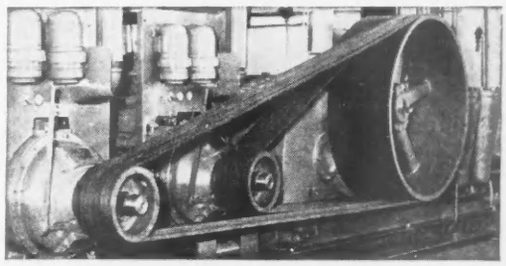
of

WORTHINGTON "QD" SHEAVES

AND

WORTHINGTON-GOODYEAR V-BELTS

For Oil Field and Industrial Use



Additional Stocks Available Through Our Distributors

A. M. LOCKETT & COMPANY, LTD.

NEW ORLEANS HOUSTON DALLAS

. . . another reason why drillers prefer

Standco

NO-SMOKE

BRAKE LINING

Standco Brake Blocks are made of cabled cords of long fibre asbestos — woven solid and reinforced with bronze wire to prevent pulling loose on the belts. They will not burn or smoke or score brake rims.

More deep wells have been drilled with Standco than with all other blocks combined. It's your answer for low-cost hole-making.

STANDCO BRAKE LINING COMPANY

Factory and General Offices

2701-2801 Clinton Drive Houston, Texas

They come back for more

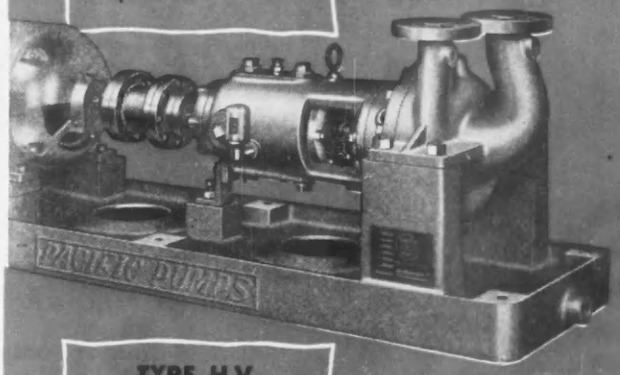
Refiner "A" installed his first Pacific pump in 1927. He has come back for more than 600 Pacific centrifugal pumps of all types.

In 1926 refiner "B" installed his first Pacific pump. He has come back for more than 750 Pacific centrifugal pumps of all types.

This could be repeated many more times—but there are only 26 letters in the alphabet.

TYPE SVC

Single Suction Process Pump
Capacities to 1400 GPM
Pressures to 650 PSI
Temperatures to 850°F



TYPE HV

Double Suction Process Pump
Capacities to 4500 GPM
Pressures to 625 PSI
Temperatures to 850°F

For long life—low maintenance costs—more and more refiners specify

PACIFIC

Precision Built

PUMPS

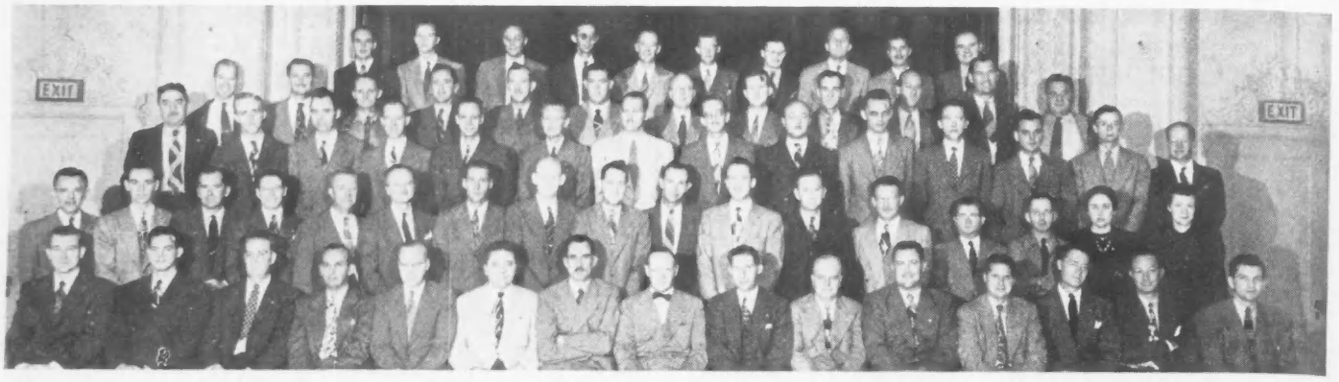
PACIFIC PUMPS INC.

HUNTINGTON PARK, CALIF.

One of the Dresser Industries

Export Office: Channin Bldg., 122 E. 42nd St., New York

Offices in All Principal Cities PR-3



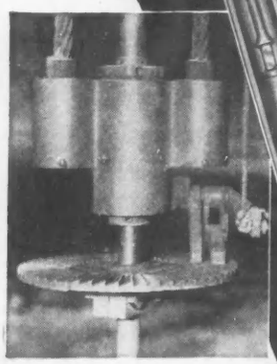
At the 17th annual meeting of Seismograph Service Corporation.

WHAT ARE YOU PAYING FOR PARAFFIN REMOVAL?

TOO MUCH — If your pumping wells are not equipped with HUBER SCRAPERS

Many major companies report Huber Scrapers have completely eliminated paraffin removal costs or reduced them to only a fraction of a cent per barrel of oil produced. Huber Scrapers, shrink-fitted to new or used sucker rods, scrape the paraffin from the tubing wall as the string rotates and reciprocates. Rods are rotated by the special Huber Rotating Rod Hanger.

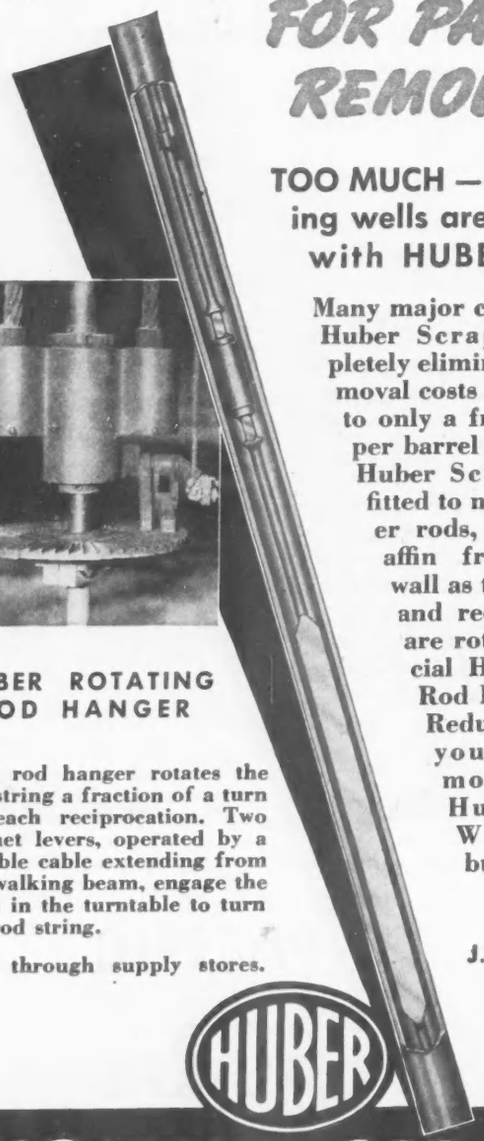
Reduce or eliminate your paraffin removal costs with Huber Scrapers. Write for latest bulletin.



HUBER ROTATING ROD HANGER

This rod hanger rotates the rod string a fraction of a turn on each reciprocation. Two ratchet levers, operated by a flexible cable extending from the walking beam, engage the teeth in the turntable to turn the rod string.

Sold through supply stores.



J. M. HUBER CORP.
P. O. Box 831
BORGER, TEXAS

HUBER
PARAFFIN SCRAPERS
SCRAPE AS THEY ROTATE AS THEY RECIPROCATE

Two New Directors Elected by Seismograph Service Firm

Laurence D. Simmons and Falkner C. Broach were elected to the board of directors of the Seismograph Service Corporation at the annual stockholders meeting on November 1 at Tulsa.

Simmons, a partner in the Laughlin-Simmons Company, which was established in 1926, served one year in the Topographical Service, U. S. Geological Department and two years in the Geological department of the Carter Oil Company.

Broach, vice president and a director of the National Bank of Tulsa, is a faculty member in the Graduate School of Banking at Rutgers University, and a member of the Association of Reserve City Bankers.

Gerald H. Westby, president, was re-elected, as were other directors, as follows: Westby, T. A. Manhart, A. J. Barthelmes, J. E. Hawkins, A. B. Chappell, J. S. Carlson, G. H. Speirs, G. W. Reed and R. W. Davis.

Houston Area Representative Chosen by France Packing Firm

Berney L. Morgan has been appointed sales representative in the Houston territory for France Packing Company of Philadelphia. He will cover the Gulf Coast, Central and East Texas, Louisiana and southern Arkansas.

Morgan was associated with Ingersoll Rand Company for 11 years prior to his appointment in the erecting, servicing and sale of engines and compressors.

Berney L. Morgan

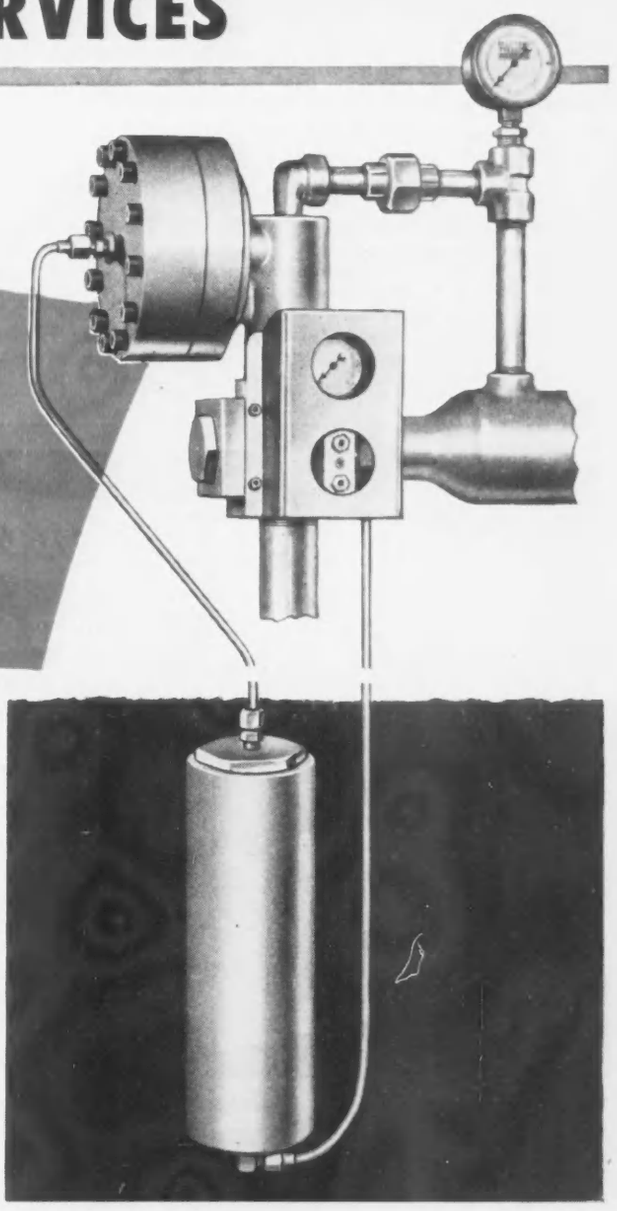
Continental Supply Appoints Tubular Sales District Manager

D. G. Weeks has been made district manager of Tubular Sales, The Continental Supply Company, for the North Texas and West Texas-New Mexico district.

He was associated with the Youngstown Tubular Division of Youngstown Sheet and Tube Company as field representative until his recent employment by Continental.

FOR SEVERE SERVICES

INVESTIGATE the PB-300



NEW GROVE *Pressure Buster* REGULATOR

• FOR REDUCING OR BACK PRESSURE SERVICE

The new Grove PB-300 *Pressure Buster* Regulators go a step further than their counterpart—the Grove *Powreactor Dome* Regulators. They are readily adapted for Pressure Reducing or Back Pressure Service by simply switching control connections. No internal changes are required. Pressure Dome can be buried to protect actuating pressure from ambient temperature changes. Because of its unique design, working parts are not exposed to the blast of flowing gas. The danger of freezing is minimized. Likewise, sand cutting action has been reduced to a minimum. Stellite faced valve and seat can be readily removed for inspection. Investigate fully today, wire or write for Bulletin 126-A.

- ★ **Working parts not exposed to flowing gas**
- ★ **Distillate isolated from cylinder charging gas**
- ★ **10,000# test seal**
- ★ **Safety cylinder charging arrangement**
- ★ **Thoroughly field tested and proved**

FACTORY BRANCHES: 3608 Navigation Blvd., Houston, Texas • 1930 W. Olympic Blvd., Los Angeles, California

GROVE

GROVE SIMPLICITY ACCURACY SAFETY "PUTS PRESSURE TO WORK"

MODEL PB-300
Pressure Buster
REGULATOR

GROVE REGULATOR COMPANY • 65th and Hollis, Oakland 8, California

George Engine Company Inaugurates Flying Emergency Mechanic Service

The George Engine Company, Inc., of New Orleans, has inaugurated a service to oil companies operating in out-of-the-way locations in Southern Louisiana. They have equipped a Republic Seabee seaplane as a flying trouble-wagon for G. M. Diesel-powered boats and rigs, so that mechanics can be flown out of New Orleans on short notice to answer emergency calls for parts or service.

This company has further rounded out its facilities by the addition of two new branches, one at Grand Isle and the other on the Harvey Canal. These are in addition to their main plant at New Orleans, the already existing Lake Charles branch and the auxiliary company plants, the Brady Engine Company at Houma and Berwick. These shops operate on a 24-hour basis.

Greer Opens Office

Greer Hydraulics, Inc., has opened a branch office at Keith Building, Dayton, Ohio, under the direction of Sumner L. Barton.

There's a heap of valve value packed into the Mission Manufacturing Company's 10,000 lb. capacity plug valve shown here—value that assures lowest cost in the long run because of the maker's uncompromising attitude toward quality.

And where you find this attitude you find Aetna bearings . . . find them in Mission Plug Valves, in scores of other oil country applications requiring exceptionally high load carrying capacity, precision smoothness and long, trouble-free performance under severe operating conditions. Your equipment can benefit, too, from the plus value built into Aetna bearings. Write for new catalog.

AETNA BALL AND ROLLER BEARING COMPANY • 4600 Schubert Ave., Chicago 39, Ill.

Houston Office: 704 M & M Building, Houston, Texas

Standard and Special Ball Thrust Bearings • Special Roller Bearings • Angular Contact Ball Bearings • Hardened and Ground Washers • Sleeves • Bushings. • Ball Retainers

Aetna

BALL AND ROLLER BEARINGS

Promotion of Two Executives Announced by Pacific Pumps

Pacific Pumps, Inc., has appointed Roy A. Dunbar general sales manager, Oil Well Plunger Pump Division, Huntington Park, Calif. Ralph C. Van Matre will succeed Dunbar as general sales manager, Oil Well Plunger Pump Division, Mid-Continent Division, Tulsa.

R. C. Van Matre

Roy A. Dunbar

Dunbar will make his headquarters at Huntington Park. He will be in charge of and coordinate all sales and service activities of the Oil Well Plunger Pump Division. Van Matre will assume charge of Pacific Pumps, Inc., Mid-Continent Division, a sales and service organization with stores throughout the Mid-Continent and Rocky Mountain areas.

A. F. Canada, Jr., will continue his present duties as Tulsa district manager, Centrifugal Pump Division.

Tom Turner Becomes Oil Country Representative for Gordon-Rupp

Tom L. Turner has been made oil country representative for Gorman-Rupp Company. From 1930 to 1937 Turner was with The Pure Oil Company and United Gas Public Service Company as civil engineer. He then joined International Supply Company, and when this organization was purchased by the Bethlehem Supply Company he was made manager of their new store at Avoca, Texas. In 1942, he was with the J. G. White Engineering Corporation as purchasing agent. Later he joined the editorial staff of *The Oil Weekly, now* WORLD OIL.

Previous to his present position he was district manager for American Iron and Machine Works.

Pittsburgh Area Representative Appointed by National Supply

Robert J. Casterton has been appointed sales representative in the Pittsburgh district sales office of the Spang-Chalfant Division of The National Supply Company. He succeeds the late William F. Hart.

Casterton joined National Supply in 1939. He served three years with the U. S. Coast Guard during the war.

Iverson Representative Named

J. B. McDonough was added to the sales staff of Iverson Supply Company, Tulsa. He will be located at the Standard Building, Houston. Prior to his connection with Iverson, McDonough was with United Supply Company in the Gulf Coast area.

Exact positioning of the Johnston All Purpose Gun Perforator in the formation to be perforated is easily and accurately determined by actual pipe-in-the-hole tally. No re-rigging or extra equipment necessary . . . just run in the Gun Perforator assembled on the bottom joint of tubing or drill string and when the desired depth for perforation is reached, the Gun Perforator is fired by safe, positive top-hole manipulation of the pipe string, which permits the hydrostatic pressure in the hole to actuate the firing mechanism. Simple, accurate and efficient.

SAFER Gun Perforating operations because the Firing Head will not fire until subjected to *both* in-the-hole hydrostatic pressure and definite rotary and vertical manipulation of the pipe string.

POSITIVE FIRE of all projectiles is assured by the foolproof firing-head mechanism and the flash-hole design of the Johnston Perforating Gun Bodies.

SELECTED NUMBER OF PERFORATIONS is determined by the number of four, five or six-shot Perforating Gun Body Sections attached to the Firing Head.

EASIER, FASTER Gun Perforator maintenance is made possible by a minimum number of parts in the trouble-free construction of the complete Gun Perforator assembly.

A MINIMUM OF EXPENDABLE PARTS for each perforating job. No extra equipment other than the Firing Head, the Perforating Gun Body Sections and a minimum of reloading supplies is needed.

Your Pipe-in-the-Hole Tally POSITIONS The Johnston

SHOOT-N-TEST all Purpose GUN PERFORATOR

PIPE TALLY

No. Joints	Length of Joint Feet	Ins.	TOTAL Feet	Ins.
Kelly				
Float				
Drill Collar				
Reamer				
1				
2				
3				
4				
5				
6				
7				
8				
9				

Write FOR NEW DESCRIPTIVE FOLDER!

THE "SHOOT-N-TEST" FOR PERFORATING CASING and TESTING FORMATION IN ONE RUN

By unitizing the Johnston Gun Perforator with *your* regular Johnston Formation Tester and Pressure Recorder, any designated formation can be *both* perforated *and* tested in one round trip of tubing or drill string. A quick, efficient method of obtaining water shut-off information, doing exploratory work or testing for actual production.

SHOOT-N-TEST Trademark FORMATION AND CASING TESTING JOHNSTON

M. O. JOHNSTON OIL FIELD SERVICE CORP.
3035 Andrita Street, Los Angeles 41, California
"Servicing California-Permian Basin-Rocky Mountain Areas"

BRANCHES
BAKERSFIELD, CALIFORNIA • AVENAL, CALIFORNIA
SACRAMENTO, CALIFORNIA • VENTURA, CALIFORNIA
SANTA MARIA, CALIFORNIA • ODESSA, TEXAS • CASPER, WYOMING • HOBBS, NEW MEXICO

JOHNSTON OIL FIELD SERVICE CORP.
5702 Navigation Boulevard, Houston, Texas
"Servicing Mid-Continent and Gulf Coast Areas"

BRANCHES
ALICE, TEXAS • VICTORIA, TEXAS • WICHITA FALLS, TEXAS
GRAHAM, TEXAS • TYLER, TEXAS • FERRIDAY, LOUISIANA
LAKE CHARLES, LOUISIANA • SHREVEPORT, LOUISIANA
LAUREL, MISSISSIPPI • MAGNOLIA, ARKANSAS
CHICHASHA, OKLAHOMA

World Oil Announces

its EXPLORATION section

TO APPEAR FOR THE FIRST TIME IN THE JANUARY ISSUE

The Exploration Section will round out WORLD OIL's specialized coverage of the various phases of the oil producing industry. Whether your top interest is exploration, drilling, production or pipe line operations, you can turn right to a special section and be sure of finding articles which deal only with that particular phase of the industry.

Be sure you have your personal copy of WORLD OIL each month. If you are not a subscriber in your own name, enter your subscription today. Use the special order blank below.

Subscriptions limited to those in the oil producing industry

WORLD OIL

PUBLISHED MONTHLY

Specialized for exploration, drilling, producing, pipe line operations and management

3301 BUFFALO DRIVE • HOUSTON, TEXAS

I want to receive WORLD OIL. Here's my check for

☐ 3 years for $4; ☐ 2 years for $3; ☐ 1 year for $2

NAME_____ POSITION_____

COMPANY_____

STREET & NO._____

CITY & STATE_____

Check branch of industry

☐ Drilling Contractor ☐ Individual Producer
☐ Producing Company ☐ Manufacturing
☐ Pipe Line ☐ Supply

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Tarver Murphy Now Executive For Equipoise Controls, Inc.

Tarver S. Murphy, Jr., has joined Equipoise Controls, Inc., Mount Vernon, N. Y., in the capacity of vice president, and will specialize in sales engineering activities covering the Equipoise line of industrial and laboratory instruments and related equipment, in the Metropolitan New York and Northeastern U. S. area.

Tarver S. Murphy, Jr.

Murphy had been with Black, Sivalls & Bryson, Inc., since 1937. In 1940 he was appointed New York district manager and special Eastern representative of that company. Previously he had been associated with Combustion Engineering Company, Inc., at its boiler and pressure vessel plants during and for several years following his engineering schooling. He was graduated from Georgia Tech in 1932.

Sales Force Additions Made by Union Wire Rope Corporation

R. B. (Bob) Boand, formerly district manager at Chicago, has been named by the Union Wire Rope Corporation as sales manager of a new sling rope. He will headquarter at the home office in Kansas City. Other changes and additions in the Union sales force are as follows: J. J. Lester has been appointed sales representative in Oklahoma, with headquarters in Oklahoma City. C. L. Conway has been made sales representative in Kansas. He will headquarter in Kansas City, Mo.

R. B. Boand

L. A. Davis was appointed sales representative in Montana, North Dakota, South Dakota, Minnesota, and Wisconsin. His headquarters are in Minneapolis.

D. E. Bedford was made sales representative in Iowa and Nebraska, with headquarters in Kansas City, Mo.

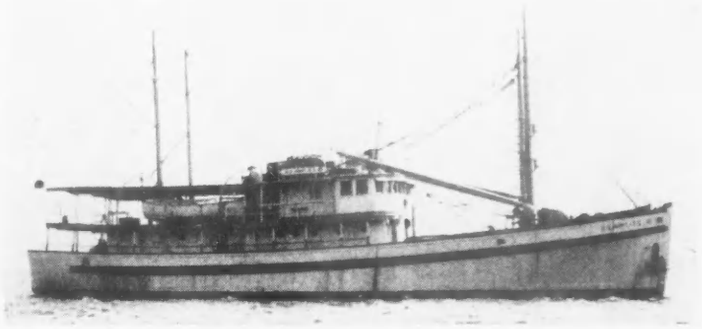
D. B. Currence was appointed district manager for Union Wire Rope in Chicago.

McCullough Tool Company Transfers Lesseig to Rocky Mountain District

Ralph Lesseig, sales engineer, McCullough Tool Company, has been transferred to the Rocky Mountain district where he will be district sales representative for McCullough with headquarters in Casper, Wyo.

For the past five years he has been working out of the McCullough Oklahoma City office.

FOR SALE AT A FRACTION OF THEIR ORIGINAL COST



Two Freight and Passenger SUPPLY SHIPS

TWIN SCREW DIESEL POWERED

20 PASSENGER • 180 TON FREIGHT

BUILT IN 1943

Cost Gov't. $300,000.00 each. Condition of Hull and Machinery excellent. Length 114'. Beam 26'6". Draft 9'6". Gross Tonnage 264. Net Tonnage 180. Ample space for additional cargo holds if desired. Powered by Twin Screw Diesel Atlas Imperial 6 Cylinder Engines developing 320 H.P. each at 350 R.P.M. 2 Auxiliary 20 K.W. Ranier Power Plants. 2 Electric Cargo Winches with booms; also Towing Winch and Electric Anchor Windlass. Radio Equipment, Meat and Fruit Cold Storage. 8 Day cruising range at 12 knots.

Deal directly with Owners

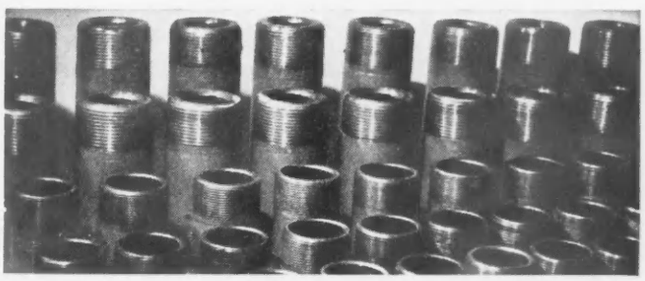
ROLAND, INC.
P.O. Box 783 • Curundu, Canal Zone
ATTENTION E. GRINSTEIN

Courtesy to Brokers

IMMEDIATE DELIVERY

SINGLE X AND DOUBLE X LATHE CUT

SEAMLESS NIPPLES



Manufactured from *new* seamless tubing, precision machined for taper and bevel, accurately threaded and gauged.

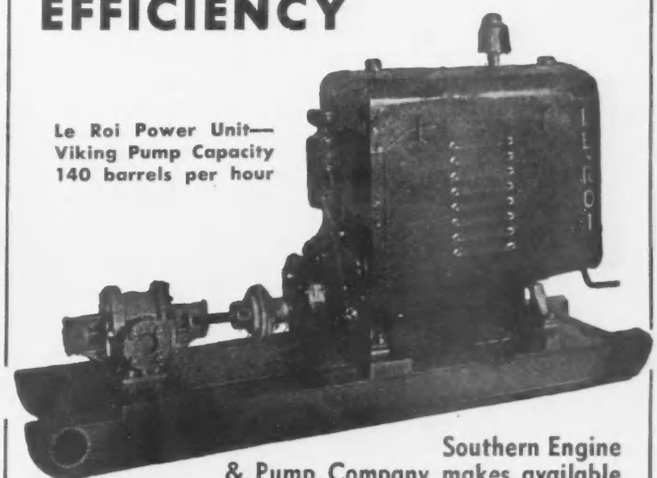
Plastic coating protects threads from rust and damage in handling to guarantee perfect threaded connections.

Sizes: ¼" through 6⅝" in standard lengths. Special sizes, brass, stainless and monel furnished to your requirements.

SOLD ONLY THROUGH SUPPLY STORES
Write for literature and price list.

Longhorn MACHINE WORKS
6823 Navigation
Houston, Texas
Dallas Branch: 3901 Southwestern

THE RIGHT TEAM FOR EFFICIENCY



Le Roi Power Unit—
Viking Pump Capacity
140 barrels per hour

Southern Engine & Pump Company makes available to you 40 years of "KNOW HOW" in your pumping requirements.

• Complete units and replacement parts at all branches.

SOUTHERN ENGINE & PUMP COMPANY

MANUFACTURERS • MACHINERY FACTORS • CONTRACTORS
Houston - Dallas - Kilgore - San Antonio
Edinburg - Lafayette, La.

For tops in travel comfort

I'll take SP's STREAMLINED Sunbeam

"Yes, Southern Pacific's streamlined Sunbeam is first choice with me every time I travel between Dallas and Houston. *There's* a train that offers the kind of comfort that really adds pleasure to my trip. Roomy, soft seats as comfortable as my easy chair at home. Ample time to enjoy a delicious dinner courteously served in a spacious diner (at moderate prices, too). And the Sunbeam is so smooth it's hard to realize you're traveling at a mile-a-minute clip (265 miles—265 minutes)."

Next time, try SP's streamlined Sunbeam. Here's the fast schedule:

SOUTHBOUND	
Lv. Dallas	5:00 p.m.
Ar. Houston	9:25 p.m.
NORTHBOUND	
Lv. Houston	4:45 p.m.
Ar. Dallas	9:10 p.m.

Southern Pacific also offers two other fine trains between Houston and Dallas; the streamlined Hustler (early morning departure) and the overnight Owl (late evening departure).

S•P THE FRIENDLY SOUTHERN PACIFIC

DALLAS
City Ticket Office
1313 Commerce St.,
Phone C. 8611

HOUSTON
City Ticket Office
913 Texas Avenue
Phone Capitol 1121

J. F. SULLIVAN, Pass. Traffic Mgr., Houston, Texas

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Director of Export Sales Named By Hamilton Rubber Company

Samuel B. Ellis

Samuel B. Ellis was named director of export sales for Hamilton Rubber Manufacturing Company of Trenton, N. J.

Ellis lived in Shanghai, China, from 1922-1930, where he was engaged in the general importing business.

In 1930 he joined The Goodyear Tire & Rubber Export Rubber Company, Akron, Ohio, where he became manager of Mechanical Goods Sales and traveled extensively abroad. In 1943 he joined the U. S. Rubber Export Company, Ltd., New York, in a similar capacity.

He will make his headquarters in the Woolworth Building, New York.

Rolo Manufacturing President On Visit to South America

Robert K. (Bob) Franklin, president of Rolo Manufacturing Company, Houston, left in October for Venezuela and Trinidad, where he will study the oil fields of these countries. Franklin recently returned from an extensive tour of oil fields in Canada and the Western U. S., including California, Montana and Wyoming.

Los Angeles Plant Purchased By Pelton Water Wheel Firm

Pelton Water Wheel Company, San Francisco, has purchased a Los Angeles plant which will manufacture and service the "Pelican," Pelton's long stroke hydraulic pumping jack.

The new plant, at 2447 East Fifty-fourth Street, was to be in production November 1. Headquarters of Pelton Water Wheel Company are at 2929 Nineteenth Street, San Francisco, where the firm has been engaged in hydraulic engineering and manufacturing for more than 65 years.

Riley Opens Offices

John C. Riley, Jr., office manager for A. O. Smith Corporation in Houston for five years, has opened offices at the Scanlan Building, Houston. Among the firms Riley represents as a manufacturers' representative are The Midvale Company, Philadelphia; Diamond Saw Works, Incorporated, Buffalo, N. Y.; Reading Chain & Block Corporation, Reading, Penn.; Electric Steel Foundry Company, Portland, Ore.; and Houston.

Win Safety Award

About 400 safety-minded workmen of Wilson-Snyder Manufacturing Division of Oil Well Supply who have been on the job for a total of 2¼ million man hours without a single lost time accident have been presented a first place safety award of the National Safety Council.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Swart Elected Vice President of Security Engineering Company

K. H. Swart has been elected vice president of the Security Engineering Company, Inc. Along with his new responsibilities he will retain his present position as chief engineer.

K. H. Swart

Swart was formerly engaged in engineering work for the Metropolitan Water District of Los Angeles and the Kettleman North Dome Association. He has been with Security Engineering for 13 years and has been active in the design and development of Securaloy pipe and production accessories, the Security casing scraper, rock bit, hole opener and coring bit.

Canadian Firm to Distribute Spudders for Bucyrus-Erie

Appointment of Wilkinson & McClean Ltd., of Calgary, Edmonton and Lethbridge, Alberta, Canada, as distributors for Bucyrus-Erie blast hole drills, prospecting drills, and bit dressers was announced by Bucyrus-Erie Company, South Milwaukee.

Wilkinson & McClean Ltd. will handle the Bucyrus-Erie 22-T, 27-T, 29-T, and 42-T blast hole drills; prospecting drills, and the No. 8 and No. 12 bit dressers. Wilkinson & McClean Ltd. also handle Bucyrus-Erie ⅜ to 2½-cubic yard excavators, electric quarry and mining shovels, and walking draglines.

Mechanical Manufacturing Names Gulf Coast Representative

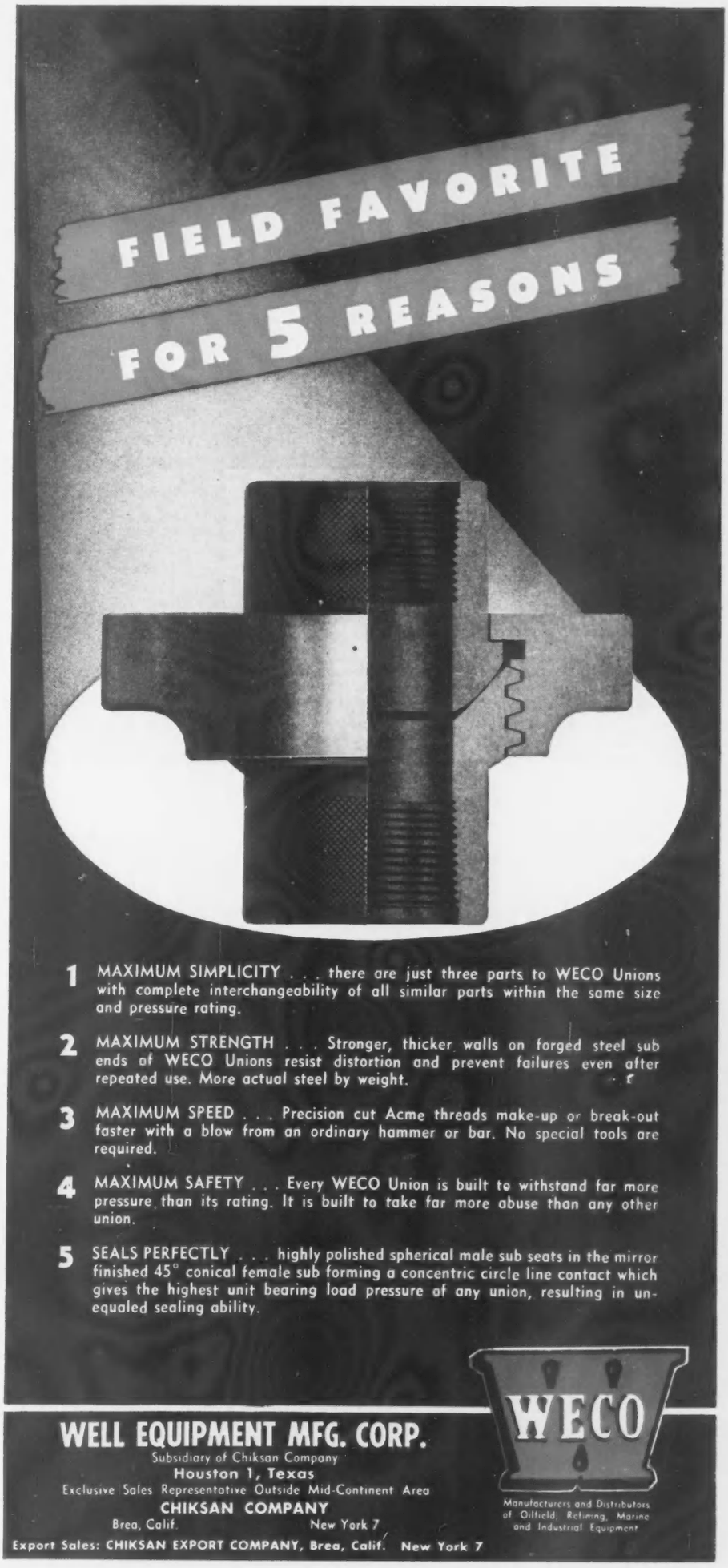
W. A. Scott of Houston has been named Texas Gulf Coast representative for Mechanical Manufacturing Company, Inc., Fort Worth. Scott, who has an office in the West Building in Houston, has had 35 years' experience in the oil field equipment and supply business, with the past eight years in the Gulf Coast area.

W. A. Scott

Oil field specialties manufactured by Mechanical include Bell standard and flexible tubing swabs, Hessman-type sand pumps and Mechanical derrick mules.

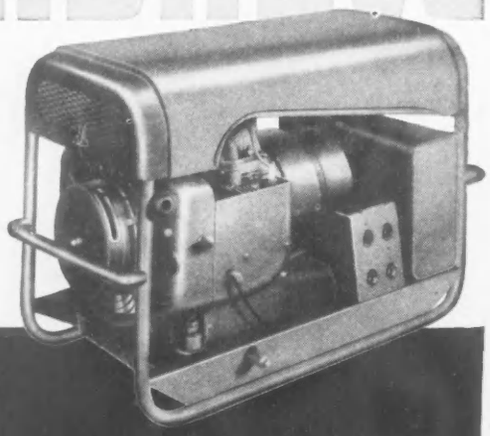
Sales Manager Named

O. E. McCullougs, Jr., has been appointed district sales manager of Stacey-Dresser Engineering, a member of Dresser Industries, Inc. His office will be in the Praetorian Building in Dallas, Texas. McCullough goes to Dallas from the company's Cleveland office.


FIELD FAVORITE
FOR 5 REASONS
1 MAXIMUM SIMPLICITY . . . there are just three parts to WECO Unions with complete interchangeability of all similar parts within the same size and pressure rating.
2 MAXIMUM STRENGTH . . . Stronger, thicker walls on forged steel sub ends of WECO Unions resist distortion and prevent failures even after repeated use. More actual steel by weight.
3 MAXIMUM SPEED . . . Precision cut Acme threads make-up or break-out faster with a blow from an ordinary hammer or bar. No special tools are required.
4 MAXIMUM SAFETY . . . Every WECO Union is built to withstand far more pressure than its rating. It is built to take far more abuse than any other union.
5 SEALS PERFECTLY . . . highly polished spherical male sub seats in the mirror finished 45° conical female sub forming a concentric circle line contact which gives the highest unit bearing load pressure of any union, resulting in unequaled sealing ability.
WELL EQUIPMENT MFG. CORP.
Subsidiary of Chiksan Company
Houston 1, Texas
Exclusive Sales Representative Outside Mid-Continent Area
CHIKSAN COMPANY
Brea, Calif. New York 7
Export Sales: CHIKSAN EXPORT COMPANY, Brea, Calif. New York 7
WECO
Manufacturers and Distributors of Oilfield, Refining, Marine and Industrial Equipment

DEPENDABLE

LIGHT & POWER
for Oil Field Service



AIR-COOLED HEAVY-DUTY
ONAN "CK"
ELECTRIC PLANTS

Available in A.C. or D.C. models, conservatively rated at 3,000 watts, built for heavy-duty service but compact and light in weight (only 315 lbs.), Onan CK Electric Plants are replacing bulky, heavier units for drill rigs, well-servicing and other oil field uses. Equipped with convenient carrying frame for easy moving on the job. Driven by the Onan 10 hp, 2-cylinder opposed, air-cooled CK engine with Onan heavy-duty generator direct-connected. Self-rewinding Readi-Pull starter included as standard equipment. Other models available with manual, Readi-Pull or electric starting. Plug-in receptacles. Weather hood, hinged for easy servicing, protects plant.

Models for every oil field job

Lightweight: 500 to 3000 watts

Gas-gaso-powered: 3 to 35KW

Diesel Plants: 2½ to 35KW

Onan PRODUCTS

***Heavy-duty**, one and two-cylinder air-cooled models. Two, four and six-cylinder water-cooled models. Gas-gaso-powered: 350 to 35,000 watts. Diesel-powered: 2,500 to 35,000 watts.*

Write for Folder
D. W. ONAN & SONS INC.
5344 Royalston Ave. Minneapolis 5, Minn.

HOT FORGED FROM SOLID STEEL BARS!

TIME AND TOOL SAVER!

CATAWISSA
HOT FORGED STEEL
LUG NUT UNION

CAN BE APPLIED WITH EITHER A HAMMER OR WRENCH!

For all piping purposes requiring a quick opening and quick closing union, here is time and tool economy without sacrificing efficiency or dependability! Triangular shaped lug nut eliminates distortion or breaking (straight surface for hammer prevents glancing blow), gives you quick, easy application without thread crossing or sticking!

1" TO 4" SIZES WITH FULL ACME THREADS IN THE UNION NUT

STANDARD WEIGHT to 3000-lbs. O. W. G.
DOUBLE EXTRA HEAVY to 6000-lbs. O. W. G.

DISTRIBUTED BY
OIL WELL SUPPLY COMPANY
BRANCHES SERVING ALL OIL FIELDS

WRITE FOR BULLETIN 10-A
CATAWISSA VALVE & FITTINGS COMPANY CATAWISSA, PENNA.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Paul D. Torrey Becomes New President of Lynes, Inc.

Paul D. Torrey, petroleum engineer, has been made president of Lynes, Inc., Houston. Torrey was formerly associated with The Sloan and Zook Company as consulting engineer.

Paul D. Torrey

Torrey served two years with the Oil and Gas Division of the U. S. Geological Survey in Utah, Wyoming, Montana, Arkansas, and Pennsylvania. In 1927, he went with the Northwestern Pennsylvania Oil Producers Association as geologist and petroleum engineer. A year later he opened his office as consulting geologist and engineer. He was employed by The Sloan and Zook Company in 1935 and sent to Houston, where he was geologist in charge of exploration work in the Texas Gulf Coast and Louisiana.

Two Firms Combine Resources On Dreadnaught Equipment Line

The Beaumont Iron Works Company of Beaumont, Texas, and the Atlas Engineering Works of Houston, are combining resources to produce and sell the "Dreadnaught" line of oil well exploratory, producing and drilling equipment.

The announcement was made by W. S. Morris, vice president of American Locomotive Company, and T. L. (Doc) Fontaine, president and principal owner of the Atlas Engineering Works. Beaumont Iron Works is a subsidiary of American Locomotive.

Under the terms of the new agreement, Atlas Engineering will be the exclusive sales agency for draw works, coring reels, Christmas trees and other well-head equipment in the Dreadnaught line, all of which will continue to be produced at Beaumont. The existing Beaumont Iron Works oil field sales staff will be amalgamated with the Atlas forces.

Production at the Beaumont plant, and management of Alco's heat exchanger maintenance center there, will continue under the direction of James F. Baldwin, manager of the Beaumont Iron Works Company.

A life-long resident of Texas, Fontaine was president of the Houston Junior Chamber of Commerce in 1938 and served both in 1938 and in 1939 as president of the Texas Junior Chamber of Commerce.

Before joining the Atlas Engineering Works in 1945, he was associated with production activities of Humble Oil & Refining Company for 18½ years. In May of this year he became principal owner of the Atlas Engineering Works and has announced that a reorganization meeting of the company will be held in the near future.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Gardner-Price Is Mid-Continent Distributor for Oshkosh Motor

Harley Price

Ralph Gardner

Gardner-Price Company, Tulsa, has been appointed Mid-Continent representative for Oshkosh Motor Truck, Inc.

Ralph Gardner and Harley Price formed Gardner-Price Company in May, 1948. They represent a number of Eastern manufacturers serving the oil industry.

Prior to the formation of their company, Gardner was sales manager for Braden Steel Corporation. He served with the Naval Air Corps during the war. Price was divisional sales manager of the Murphy Diesel Company for seven years. Prior to that he was sales representative for General Motors diesel engines.

Gulf Coast Equipment Manager Appointed by Mud Products

Sam T. Dyer has been named manager of the Gulf Coast Equipment Division of Mud Products, Inc.

Dyer was formerly district manager and foreign sales representative of Reed Roller Bit, and prior to joining Mud Products, was special sales representative with Jarecki Supply Company.

Dyer, with headquarters in Houston, will represent the equipment division of Mud Products in the Louisiana and Texas Gulf Coast territory, servicing supply stores and drilling contractors and acting as engineering consultant on mud handling problems.

Bolger Succeeds Eustice as President of W. C. Norris

Joseph H. Eustice, who has been on leave of absence for the past 12 months from W. C. Norris Company, has announced his resignation as president because of continuing ill health.

E. C. Bolger, chairman of the board of W. C. Norris Manufacturers, Inc., will also assume the duties as president.

Jarecki Manufacturing Names Office Manager at Houston

Howard H. Godfrey has been appointed office manager by Jarecki Manufacturing Company, with his headquarters at Houston. Prior to this appointment, Godfrey was manager of the credit department, in which position he is succeeded by Paul W. Crawford, who recently joined Jarecki. He previously was assistant credit manager of Goodyear Tire and Rubber Company at Houston.

It's Powered Right when It's Powered by Briggs & Stratton

The dependability and efficiency of "powered" equipment depends on the engine that drives it.

Specify Briggs & Stratton 4-cycle, air-cooled engines. It's the right power for the most exacting requirements. No other single cylinder, air-cooled, gasoline engine gives you the same value, performance, and dependability.

BRIGGS & STRATTON CORPORATION
Milwaukee 1, Wis., U. S. A.

4 CYCLE
BRIGGS & STRATTON
GASOLINE ENGINES
World Wide FACTORY SUPERVISED SERVICE

Alden G. Roach Named President Of Columbia Steel Company

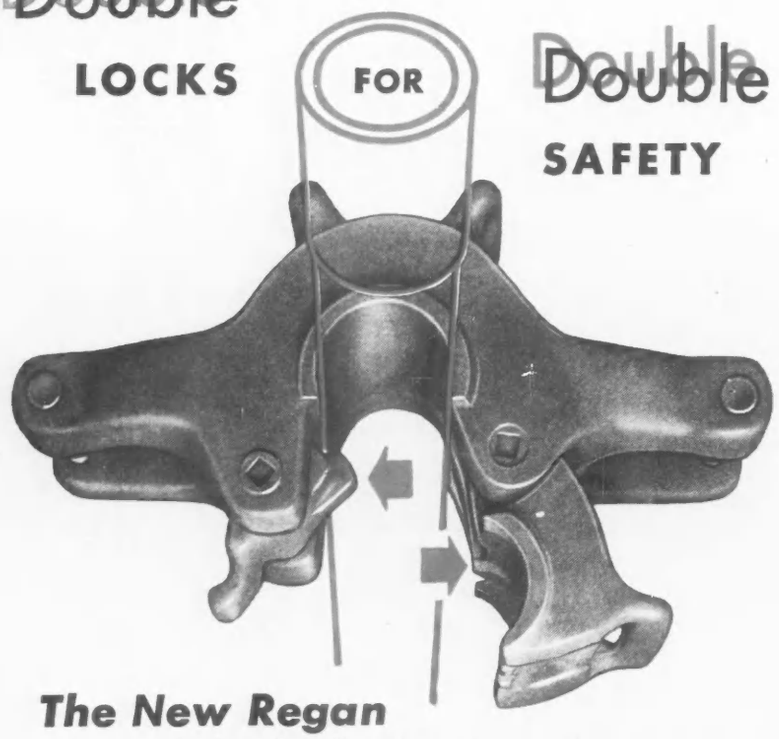
Alden G. Roach, president of Consolidated Western Steel Corporation, has succeeded J. Lester Perry as president of Columbia Steel Company, subsidiary of U. S. Steel Corporation on the Pacific Coast. Perry, formerly president of Carnegie-Illinois Steel Corporation, was called back from retirement May 1, 1947, to assume the presidency of Columbia following the death of President William A. Ross. Perry will remain with U. S. Steel in an advisory capacity.

For eight years Roach has been president of Consolidated Steel Corporation, which recently became a subsidiary of U. S. Steel under the new name of Consolidated Western Steel Corporation. Roach will continue as president of Consolidated Western.

Gulf Coast Field Sales Manager Appointed by Patterson-Ballagh

Promotion of T. M. Smith, Jr., to manager of Field Sales and Service for the Texas Gulf Coast was announced by the Patterson-Ballagh Division of Byron Jackson Company. Aiding Smith will be Ralph Snowden, located at Alice, and A. C. (Tag) Colgin at Houston. Colgin will be transferred to Houston from Shreveport.

Double LOCKS FOR Double SAFETY



The New Regan Dualock Tubing Elevator

Tubing can never drop when you use this newly-designed elevator. Even if the door is not locked a positive-acting safety latch rotating with the lock keeps tubing locked within the elevator. Regular door lock has double locking faces. No other elevator has this patented two-way safety design. Body is a heat treated, solid alloy steel casting designed with a 4 to 1 safety factor. Engineered and produced to rigid Regan Standards, Pre-tested under every field condition. Now, proved in performance by users, the Regan *Dualock* Tubing Elevator is the number-one choice of operators who demand maximum safety. *Send Today for Detailed Bulletin.*

Regan Forge & Engineering Co.

Quality – Wrought on the Forge of Experience

E-1

SAN PEDRO, CALIF. HOUSTON, TEXAS

Exclusive Mid-Continent Representatives: Hunt Tool Co., P.O. Box 1436, Houston, Texas

Exclusive Export Representatives: Hunt Export Co., 19 Rector St., New York, N. Y. Avda Pte., R. Saenz, Pena 832, Buenos Aires, Argentina

Ralph M. Hoffman Is Elected Vice President of Link Belt

Ralph M. Hoffman, president of Link-Belt Company, Pacific Division, San Francisco, was elected a vice president of the parent Link-Belt Company.

Ralph H. Hoffman

Hoffman joined the predecessor of the Pacific Coast Company—Meese & Gottfried Company — in 1913. During his career, he has served in many important executive capacities in both the parent and subsidiary companies. He continues president of Link-Belt Company, Pacific division, the position he has held since 1943.

Eastman Oil Well Survey Head Makes Tour of Central Europe

H. John Eastman, president of the Eastman Oil Well Survey Company, with headquarters at Denver, has completed a tour of England, France, Germany, Belgium, Holland and Luxembourg to confer with officials of 12 leading independent oil companies regarding the problem of supplying them with urgently needed oil tools, equipment, and oil well surveying service for use in prospecting new fields in Europe.

Eastman made the trip at the request of Werner Mueller, owner of one of the largest oil tool manufacturing plants in Central Europe.

In May, Eastman financed a trip to the U. S. for Mueller in order that he might visit the Tulsa Oil Show to see first-hand the new equipment used in the oil industry of this country.

William C. McAfee Named Manager Of Oilwell's Store at Mission

William C. McAfee has been promoted to manager of the Oil Well Supply Company store at Mission, Texas.

McAfee, a native of Trenton, Texas, succeeds Louis C. Hurley, who has joined the Production Equipment Sales Department and is presently at the company's Imperial Works Plant at Oil City, Penn., for a training course in production equipment.

McAfee served in the ETO and shortly after his discharge, in March, 1946, was employed by "Oilwell" as a storeman in the Mission store, the position he held at the time of his new appointment.

Hurley, a native of Chattanooga, Tennessee, became connected with Oil Well Supply Company at its world headquarters at Dallas, Texas, in November, 1936.

Van Kampen Joins Kerotest's Southwest Sales Division

Kerotest Manufacturing Company announced the appointment of Adrian Van Kampen to the Southwest sales division, with headquarters at Houston. He will cover the territory formerly serviced by Walter Cox.

Van Kampen was for many years associated with Allis-Chalmers as sales engineer.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

George E. Purdy Joins Staff at Tretolite Research Laboratory

George E. Purdy, formerly with General Chemical Company, has joined the Tretolite Company research laboratory at St. Louis. He will be engaged in the investigation of corrosion problems, and in the development and application of Tretolite's new Kontol Corrosion Inhibitors.

George E. Purdy

Purdy is a graduate of the University of Missouri. During World War II he served four years with the Army, with a year in the European theatre in the Corps of Engineers.

M. E. Nicklin Named Manager of Sales For Oil Well Supply Company Division

M. E. Nicklin, manager of Oil Well Supply Company's export division since March, 1940, has been appointed manager of sales for the company's Witte Engine Works Division at Kansas City, Mo. M. E. Keenan, assistant manager of the export division, which has headquarters at New York City, was named to succeed Nicklin.

Nicklin has been connected with "Oilwell" eleven years, beginning as sales engineer at Oil City, Penn., in 1937 and continuing in that position until his appointment as export division manager in 1940.

Keenan joined Oil Well Supply Company 28 years ago as a clerk in Pittsburgh. From 1929 to 1942 he was at Calgary, Canada, as manager of Calgary sales and later district sales manager. In June, 1942, Keenan was transferred to the export division in New York where he was assistant to division manager and later sales manager before his appointment as assistant division manager in 1945.

Frank Ostrander Retires After 43 Years with National Supply

Frank T. Ostrander, vice president in charge of the New York City office of National Supply Export Corporation, retired in October after 43 years of service. He will remain with the firm in an advisory capacity.

Ostrander, a resident of Chappaqua, N. Y., was formerly associated with the Shelby Seamless Tube Company, now the National Tube Company, and the American Bridge Company. He was employed by National Supply in 1905.

Fred Jobst In Venezuela

Fred Jobst is in Venezuela in the interest of companies represented by Val R. Wittich, Jr., of New York, which include S. R. Bowen Company, Emsco Screen Pipe Company, Houston Slush Pump Company, Miller Sand Pump Company, Texas Iron Works and Wagner-Morehouse. Jobst will visit oil fields of the major companies before returning around the end of the year.

WORLD OIL'S Trading Post

CLASSIFIED ADS

SERVICES · PERSONNEL · USED EQUIPMENT

Rates: Regular Classified (undisplayed) set in this size type: 10 cents per word. If Box Number is to be used count an additional six words. Replies forwarded without charge. Situation Wanted: 5 cents per word. Display advertisements, set in suitably larger type with ruled border: $9.00 per column inch per insertion. Situation Wanted: $4.50 per column inch. **All classified ads payable in advance.** 10% Discount if 3 or more insertions are ordered at one time. **COPY DEADLINE:** 5th of month preceding date of issue. Send copy and checks to: Trading Post Section, World Oil, P. O. Box 2608, Houston, Texas.

HELP WANTED

HELP WANTED

FOREIGN EMPLOYMENT

In

SAUDI ARABIA

For

Qualified

ENGINEERS

Petroleum • Production • Mechanical • Electrical
Civil • Power
Process • Chemical • Architectural

GEOLOGISTS

Surface Mapping • Sub-surface • Economic

SENIOR PALEONTOLOGIST

ENGINEERS

Triangulation Party Chief • Leveling Party Chief

SURVEYORS

Triangulation • Recorder Triangulation • Precise Leveling

ACCOUNTANTS

Domestic Training Program for young Graduate Engineers prior to foreign assignment. Career employment opportunities. Board and Room furnished. Vacation in U. S. with salary end of each 24 month period. Benefit plans.
If interested apply by letter giving complete employment and personal history.

ARABIAN AMERICAN OIL COMPANY

200 Bush Street, Dept. "F"
SAN FRANCISCO, CALIFORNIA

The Production Department of well established growing independent needs a young graduate Petroleum Engineer with one or more years field experience. Time to be devoted to drilling and production. Complete information is desired with first letter, to:

HUSKY REFINING COMPANY
Box 380 Cody, Wyoming

LEASES, DRILLING, ACREAGE, ETC.

■ SEE A. L. BOWLES, ADA, OKLAHOMA, FOR SHALLOW DRILLING DEALS IN OKLAHOMA.

■ We will buy producing or non-producing oil royalties. Send particulars. Standard Security Co., 115 Broadway, New York 6.

ROYALTIES IN HOT AREAS!

■ Recent strikes have focused attention on Montana's deeper oil zones and major companies are moving in fast, drilling and leasing. We buy direct in the field, sell direct to our customers. Write LANDOWNERS ROYALTIES COMPANY, Box 1225, Great Falls, Montana.

FOR SALE

■ FOR SALE. Two new 6NKU Waukesha. Delivered 7/1/48. Stored under cover. List price. No bonus. No trade. Harris Drilling Company, 525 Wichita National Bank Building, Wichita Falls, Texas.

FOR SALE

MISTLETOE

What better expresses the Christmas spirit. Five pound carton shipped express prepaid to any point in U. S. A. $3.75. **R. W. Elliott,** Bertram, Texas.

■ DRILLING equipment, reconditioned ready for delivery, Failing, Longyear, Franks, Eli, Tulsa, American, Sullivan, Ft. Worth, Wichita, Keystones, National, Standards, also steel derricks, cable tools, cable and good used casing, most sizes. Pressey & Son, Pueblo, Colo.

NEW CLOSING DATE for The Trading Post

Effective with the October issue, advertisements in The Trading Post section of WORLD OIL must be received by the publisher on or before the 5th of the month preceding date of issue.

HELP WANTED

EXPERIENCED ENGINEERS NEEDED

An American oil company, affiliated with Standard Oil Co. (N. J.) and located in South America needs experienced engineers as follows:

PRODUCING

Petroleum, Electrical, Mechanical, Civil and Construction Engineers and Geologists

REFINING

Refinery Maintenance and Process Engineers, Designers and Equipment Inspectors.

Degree and three years minimum experience.

☆ ☆ ☆

Liberal salaries, other cash payments, retirement plan, paid vacations, excellent opportunities for career work.

☆ ☆ ☆

Send details of experience and education to:

Box 308-D
Radio City Station
New York 19, N. Y.

Replies are held strictly confidential.

FOR SALE

■ One 76 Speed Star Drilling Rig Complete. Inquire 438 N. Elm St. or Phone 4141, Henderson, Ky. Dietz Drilling Co.

FOR SALE

■ 2-ELI-M5 Seismograph rigs complete. Good condition. Write Charles L. Farris, General Delivery, Wichita Falls, Texas.

FOR SALE
OIL BULK STORAGE PLANT
13—30,000 gal. tanks, size 10 x 48
1—20,000 gal. tank
all horizontal
1 High Pressure Boiler—175 H.P.
WRECKERS & EXCAVATORS, Inc.
58-58 Grand Ave. Maspeth, N. Y.
DAvenport 6-2800

FOR SALE: 3 Used Drilling Rigs located in Kansas and Oklahoma. Two are Diesel electric and one Waukesha powered unit. Complete inventory and prices upon request. **Cities Service Oil Co.**, Patridge, Bartlesville, Okla.

One 87′ Lee C. Moore jackknife mast with 6½′ substructure; complete with floorboard. In good condition.
THE CHET WHALEY WELL SERVICING COMPANY
Phone F-1998, 909A City Natl. Bank Bldg., Houston, Texas

It's New... Check It!

PIPE GRINDING MACHINE designed and built to give pipe line contractors maximum service in polishing the bevel on plain end pipe in preparation for welding. The machine can be placed on pipe easily and quickly, and will clean the bevel on 24-inch pipe in 15 seconds, whereas a man with file would have to work at least 15 minutes. The grinder is constructed for durability, light weight, effectiveness and economy. Electrically driven, it may be operated from electric welding machines on the line.

The Machine was perfected, and now being manufactured by

WICHITA TOOL REPAIR CO.
of Wichita Falls, Texas
Under license from O. R. Hall, inventor.

SITUATIONS WANTED

■ DEALING WITH EUROPE? Export Manager, Doctor of Economics and Laws. European background and American experience, good organizer with constructive ideas seeks change of position. Address: Box 84W, c/o World Oil, Houston, Texas.

■ PETROLEUM ENGINEER GRADUATE—fourteen years experience, desires responsible position with independent operator, private individual or consulting firm. Capable of field and office supervision of drilling, producing, engineering, and geological work. Details upon request. Married, family. Address: Box 83W, c/o World Oil, Houston, Texas.

■ CHICAGO EXECUTIVE available for part time responsibility with growing concern maintaining or contemplating Chicago headquarters. Well qualified in accounting, taxation, office and corporate procedures. Address: Box 82W, c/o World Oil, Houston, Texas.

NEW Books

Taft-Hartley Act

"The Taft-Hartley Act After One Year" is a study in two parts of how the Act has operated and how it has been interpreted.

In Part 1, the Act in Operation, the policies that have developed in relation to filing requirements, union security, freedom of speech, bargaining elections, strike responsibility, political expenditures, employer interference and injunctions as well as a statistical gauge of who uses the act and how are reported and analyzed.

Part 2 explains how the various provisions of the act have been interpreted by administrative agencies and the courts, discussing such broad subjects as coverage, domination of unions, discrimination, collective bargaining, unfair labor practices, NLRB procedure, suits, welfare funds, political action, with a final chapter analyzing the impact of the act on labor and union contracts, appending a catalogue of a number of actual contract clauses reflecting the effect of various provisions of the new law.

Other material is included that is of value: the text of the act with annotations citing cases decided during the first year of operation, the full text of new NLRB rules and regulations, up-to-date directories of NLRB offices and personnel and of the Federal Mediation and Conciliation Service, and a checklist of state laws regulating union security.

The Bureau of National Affairs, 1231 24th Street, N.W., Washington, D. C.

Early Oil Days

A study of Western Pennsylvania during the first intense development of the oil industry from 1860-1892 is "Early Days of Oil." Edited by Paul H. Giddens, it contains about 365 of the pictures made by John A. Mather of boom towns, early wells, primitive equipment, and disasters such as the Titusville fire and flood of 1892. Mather followed oil men all over the state and many of his pictures show their way of life along Oil Creek, their transportation difficulties, their triumphs.

Giddens is chairman of the History Department at Allegheny College and curator of the Drake Museum, from which the Mather pictures were selected. He previously authored "The Birth of the Oil Industry."

Princeton University Press, Princeton, N. J., price: $6.

Texas Map

A new North, North Central and East Texas oil and gas field map, includes Railroad Commission districts 5, 6, 7B and 9, and a portion of 7C. Area covered is from San Angelo to the Louisiana line and from Austin to the Red River.

There are more than 1150 oil, gas, and condensate fields shown with their discovery dates, gravity of production, the name and depth of the producing formation, the size and ownership of oil and gas trunk pipe lines, and refineries and natural gasoline plants showing capacity, etc.

This map is 39 x 73 inches and is drawn to a scale of one inch equals ten miles. Oil fields are shown in green, gas fields in red, and condensate fields in yellow. Time required for research and construction of this map has been in excess of a year. It was compiled and published by Lee Jerome Wilson.

Commercial Drafting Service, 1651 Colquitt Street, Houston 6.

Limestone Porosity

"The Nature and Origin of Limestone Porosity" is the subject of Volume 43, Number 4, of the *Quarterly*, issued by the Colorado School of Mines and prepared by Richard B. Hohlt, who reports on research conducted under a fellowship provided by the California Company.

The 52-page publication contains 20 illustrations, including photomicrographs and petrofabric diagrams prepared in the course of the research.

Department of Publications, Colorado School of Mines, Golden, $1 postpaid in the U. S.

Oil Field Structure

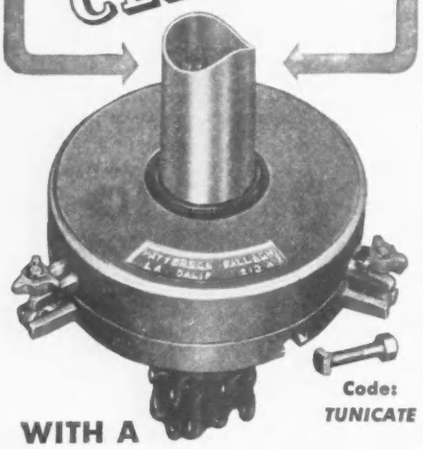
The most recent book of the American Association of Petroleum Geologists, Tulsa, is "Structure of Typical American Oil Fields" Volume III, with a foreword by J. V. Howell, consulting geologist and secretary-treasurer of the AAPG. Twenty-four papers describe oil fields in 13 states, ranging from Alabama to California and from Texas to Canada.

The newest in the AAPG structure series, it contains descriptions of oil and gas fields characterized by distinctive and peculiar features of stratigraphy, structure, and accumulation. Like the preceding volumes of the popular AAPG series of Typical American Oil Fields, this third volume is a symposium on the relation of oil accumulation to structure. The fields described cover a wide variety of conditions: off-shore, slant-hole, multiple-well drilling from a single platform location in the Gulf of Mexico (Creole field, La.), reservoirs hidden beneath hundreds of feet of volcanic rocks (Gramp's field, Colo.), oil accumulations in reef formations (Norman Wells, Canada), and pools trapped by faults. These and other examples of exceptional as well as commonplace types of structure give this book a practical value to geologists in search for oil and gas.

In the foreword, Howell points out the exploratory and development methods which have come into general use since the appearance of Volumes I and II of this series and indicates that there are many unorthodox traps (and oil pools) awaiting the imaginative geologist.

The American Association of Petroleum Geologists, Box 979, Tulsa, $3.50 to AAPG members and $4.50 to others.

WIPE MILES OF TUBING CLEAN!



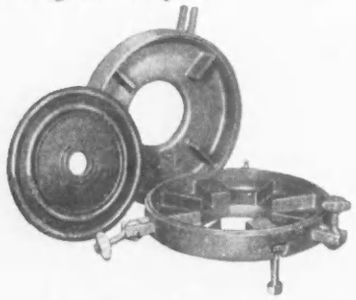
Code: TUNICATE

WITH A

PATTERSON-BALLAGH TUBING WIPER

Wipes tubing dry. No oil to drip on hoist, rig or tools. Rugged alloy steel housing holds free-floating, self-centering, standard Patterson-Ballagh Special Rubber Wiper.

Housing bolts to flange type heads on bolt centers 9 to 16". Tubing spider is set on top of housing which is constructed to take heaviest tubing loads. Three eye bolts, provided with hammer nuts, lock down lid to hold wiping rubber. Special Rubber Wiper uses same tension principle as Patterson-Ballagh Drill Pipe Wipers. Steel reinforcing ring, molded inside rubber, makes center wiping web flexible, resilient yet firm, durable, and long lasting. Flash-fireproof.



Order complete assembly by code name: TUNICATE. Wiping rubber replacement, code: WINNOW. Send for Catalog No. 180 or see your Supply Store.

Specify PROTECTION PROVEN

PATTERSON-BALLAGH

DIVISION OF BYRON-JACKSON CO.

TUBING WIPERS

Main Office: P. O. Box 2493, Terminal Annex, Los Angeles 54

Offices:
HOUSTON • SAN FRANCISCO
NEW YORK • LONDON • BUENOS AIRES

SQUEAKS from the BULLWHEEL

Poet's Nook

The time is coming
(So goes the rumor)
When we'll have to laugh
At the boss' humor.

Encore

Joe jilted Ellen.
Ellen sued.
Joe married Helen.
Hell ensued.

Justice, At Last

Joe and Jack were identical twins.

When they were kids, Joe threw spitballs and Jack got punished for it.

When they were young men, Joe was arrested for speeding and Jack had to pay the fine.

When Jack found a beautiful girl, Joe ran off with her.

When Joe robbed a bank, Jack got 20 years for it.

But finally Jack got even.

Jack died and they buried Joe.

The Old, Old Story

The oil man died, went to heaven, and was met at the gate by St. Peter, who said: "Can't let you in. We've got enough oil men up here now."

The oil man pondered a while, then asked: "If I get a few of 'em out of here, would there be room for me?"

"Well, I reckon so."

So the oil man went in and prowled around until he came upon another oil man. "Say, Joe," he whispered, "you heard about that new strike they made in Hell?"

"No!" gasped the other, and hurried off to Hell to get in on the play.

After he had pulled the stunt a dozen times, the oil man reported back to St. Peter and got permission to remain.

But after a few days he began to fret. He bit his nails, lost his appetite.

"Now what?" said St. Peter. "Aren't you happy here?"

"To tell you the truth, I'm not. I've got to get out of here. There may be something to that story of mine, after all."

Love's Labor Lost

"I'm through going out with college boys."

"Me, too. They start out holding your hand and wind up trying to shuffle the whole deck!"

Spring Is in the Air

"Young man, you've been seeing my daughter a lot lately. Is everything on the square?"

"Oh, no, sir! It's mostly on the couch in the living room."

He Showed 'Em

"At the race track this afternoon, I bent over to tie my shoe lace and a near-sighted groom strapped a saddle on me."

"What happened?"

"I came in third."

"Look, Momma! I think I've stumbled on to some of that tidelands oil."

PETROLEUM ENGINEERS
CABLE & STINE
WICHITA FALLS, TEXAS

EXPERIENCED PRACTICAL AND TECHNICAL CONSULTING PRODUCTION ENGINEERING SERVICE

•

SPECIALIZING in MODERN SECONDARY RECOVERY

10 GOOD REASONS WHY OPERATORS PREFER

McCullough
GUN PERFORATOR SERVICE

1. **MEETS EVERY CONDITION.** Guns fired either electrically or mechanically: guns run on cable, sand line, drill pipe, tubing, or on piano-wire measuring line in extremely high-pressure wells.
2. **SIMULTANEOUS FIRING** under all conditions gives exact spacing of shots, perfect perforation pattern, and saves down-the-hole time.
3. **ACCURATE DEPTH MEASUREMENTS** put the shots right where you order them.
4. **MAXIMUM PENETRATION** of bullets into the formation, as proved repeatedly in competitive field tests.
5. **GUNS TO FIT EVERY CONDITION.** McCullough employs more than 30 different types and sizes of guns.
6. **ALL SIZES OF BULLETS** from $\frac{1}{16}$" dia. up to $\frac{3}{4}$" dia., to fit every possible need.
7. **BURRLESS BULLETS,** giving a completely burr-free hole, eliminating casing scraping, with *no* sacrifice of penetration.
8. **NO LOST TIME.** McCullough's simpler, lighter equipment cuts setting-up and moving-out time, speeds up every job.
9. **EXPERIENCED MEN.** With years of experience behind them, thoroughly-trained McCullough gun-perforating crews do their jobs quickly, efficiently, safely.

These Are Some of the Reasons Behind the Proven Fact That

McCullough

PUTS THE SHOTS WHERE THEY COUNT!

10 This is a section of a McCullough **90-SHOT GUN** perforating a 15-foot section with 6 holes to the foot, at one run.

McCullough TOOL COMPANY

5820 South Alameda St., Los Angeles 11, California
405 McCarty Avenue, (P. O. Box 2575) Houston, Texas

26 SERVICE LOCATIONS

TEXAS: Houston, Alice, Cisco, Corpus Christi, McAllen, Odessa, Tyler, Victoria, Wichita Falls, San Angelo

OKLAHOMA: Oklahoma City, Guymon, Healdton

MISSISSIPPI: Laurel

NEW MEXICO: Hobbs

KANSAS: Ulysses

CALIFORNIA: Los Angeles, Avenal, Bakersfield, Ventura

MONTANA: Cut Bank

LOUISIANA: Houma, Lake Charles, New Iberia, Shreveport

WYOMING: Casper

EXPORT OFFICE: 30 Rockefeller Plaza, New York 20, N. Y.

Standco
NO-SMOKE

STANDCO BRAKE LINING

Nothing novel—no bunk, but it gets the job done without scoring brake rims. See pages 3973-3978 Composite Catalog.

Standco Brake Lining Co.
HOUSTON

Gravity Surveys

COASTAL OIL FINDING COMPANY
Established 1928
ESPERSON BLDG. HOUSTON, TEXAS

HOUSTON LABORATORIES
Analytical and Consulting Chemists
Podbielniak Gas Analyses, Oil Field Brines, Waters, Cores, Muds, etc. Reservoir equilibria studies for crude and condensate wells.
LD 267—Box 132 Houston, Texas

W. P. JENNY
Consulting Geologist and Geophysicist
AERIAL MAGNETIC AND MICROMAGNETIC SURVEYS AND INTERPRETATIONS
GEOPHYSICAL CORRELATIONS
Charter 4-4777 1404 Esperson Bldg.
Lehigh 0940 HOUSTON, TEXAS

THE FORT WORTH LABORATORIES
Analysis of oil field brines, cores, gas, oil and minerals. Field gas testing. Long Distance 138. 823½ Monroe Street, Fort Worth, Texas.

DID YOU CHECK THE
Trading Post?
TURN BACK TO PAGE 302

Fowl Play

Smith looked over his garden wall and said to his neighbor: "What are you burying in that hole?"

"Oh, I'm just replacing some of my seeds, that's all."

"Seeds!" shouted Smith angrily. "It looks more like one of my hens."

"It is. The seeds are inside."

Saucy Rascal

A rather stout schoolmistress was talking about birds and their habits. "Now," she said, "at home I have a canary, and it can do something I cannot do. I wonder if any of you know just what that thing is?"

Little Eric raised his hand, "I know, teacher. Take a bath in a saucer!"

Osculator's Error

"Why were you kissing my daughter in that dark corner last night?"

"Now that I've seen her in the daylight, I sort of wonder myself."

A Natural

"I think I'll propose my wife for Congresswoman."

"Why?"

"Because she's so good at introducing bills into the house."

Hints for Householders-to-be

"John doesn't seem as well dressed as when he married you five years ago."

That's funny. It's the same suit."

Clean Miss

When Smith walked into his friend's office, he found him sitting at his desk, looking very depressed.

"Hello, old man!" said Smith. "What's up?"

"Oh, just my wife," replied the other sadly. "She's engaged a new secretary for me."

"Well, there's nothing wrong about that. Is she a blonde or a brunet?"

"He's bald."

Self-Squirter

Farmer Brown had been on a bender in the big city and was suffering from a terrible hangover when he stumbled out at 5 o'clock in the morning to milk the cow.

"You look terrible," said the cow, bluntly. "Those circles under your eyes reach down to your knees."

"I know," said the farmer. "And milking you is only the beginning of my troubles. I'll be slaving on this durn farm 'til 7 tonight."

"Well," volunteered the cow, "I'll help you all I can. You just hold tight and I'll jump up and down."

Young Man's Fancy

A newly-wed filling out his income tax return listed a deduction for his wife. In the section marked "Exemption claimed for children," he penciled the notation: "Watch this space!"

HE HASN'T BUDGED SINCE HE CRAWLED IN 3 WEEKS AGO... —SAYS HE'S A LANE-WELLS BRIDGING PLUG!!
Dr. Otto B. Lockedup
PHSYCHIATRIC CONSULTATION
JACK HUBENTHAL